1037-C

Y4.G74/9:S.hrg.99-327

S. HRG. 99-327

GLOBAL FORESIGHT CAPABILITY OF U.S. GOVERNMENT

ORIGINAL

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON GOVERNMENTAL EFFICIENCY
AND THE DISTRICT OF COLUMBIA

OF THE

COMMITTEE ON
GOVERNMENTAL AFFAIRS

AND THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

NINETY-NINTH CONGRESS

FIRST SESSION

APRIL 30, 1985

Printed for the use of the Committee on Governmental Affairs and the Committee on Environment and Public Works

316

U.S. GOVERNMENT PRINTING OFFICE
54-844 O   WASHINGTON : 1986

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GLOBAL FORESIGHT CAPABILITY OF U.S. GOVERNMENT

TUESDAY, APRIL 30, 1985

U.S. SENATE, SUBCOMMITTEE ON GOVERNMENTAL EFFICIENCY AND THE DISTRICT OF COLUMBIA, COMMITTEE ON GOVERNMENTAL AFFAIRS, AND THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

Washington, DC.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room SD-342, Dirksen Senate Office Building, Hon. Charles McC. Mathias and Hon. Robert T. Stafford (cochairmen) presiding.

Present: Senators Mathias and Stafford.

Also present: Senators Abdnor and Humphrey.

Staff of the Subcommittee on Governmental Efficiency and the District of Columbia present: William C. Leonard, staff director; Marion Morris, professional staff member; Richard Weston, legislative director; Sandi Muschette, chief clerk; and Carrie Walters, intern.

Staff of the Committee on Environment and Public Works present: Curtis Moore, counsel; Mark Haynes, professional staff member; Charlie Richmond; Gordon MacDonald; and Justin Lancaster, fellow.

OPENING STATEMENT OF SENATOR MATHIAS

Senator MATHIAS. The committee will come to order.

The purpose of the hearing today is to explore the continuing capacity and capability of the U.S. Government to engage in global foresight in collecting information and assessing information, which gives us an opportunity to project our current knowledge as far as possible into the future.

When many people hear the term global foresight, they're inclined to think about forecasting the weather, and I suppose that that is one interpretation, but it should mean a great deal more than that. It should mean the ability to anticipate problems and to anticipate change in really every area of public policymaking and, for that matter, private decisionmaking. It attempts to answer the question, "What if?"

Dean Rusk once said that the pace of events is moving so fast that unless we can find some way to keep our sights on tomorrow, we can't expect to be in touch with today, and that really states the problem.

Foresight is the ability, if not to predict, at least to project, and it can aid policymaking and decisionmaking in many areas. Trade policy is one. Foresight can help us to determine the long-range export and import needs of our current and prospective trading partners, and how their needs match our own.

If we had had a little foresight, for example, we might be selling the soybeans that the Brazilians are now raising and selling which they never thought about growing 10 years ago.

In domestic policy, if we know with a fair degree of accuracy what foreign goods are likely to be coming into this country for the next 20 years, it certainly tells us something about our own domestic labor force and its skills and the skill it is going to need, and about domestic producers of those same goods that we will probably be importing, and it raises the questions of what retraining and retooling are called for in our domestic industry.

In the field of national security, the United States should be able to anticipate political upheavals around the world, and that foresight would enable us to take appropriate steps in terms of the size and deployment of defense manpower and weapons as well as the size and deployment of economic aid to other countries, and the form that aid should take.

In economic security, if we know the long-range supply and demand for energy and food, and the sources of such supply and demand, would not that kind of information guide the United States in bilateral and multilateral trade agreements? What assumptions can reasonably be made about long-term energy prices and what effect might that information have on sources and patterns of energy used? What raw materials and markets can the United States supply, and which ones must we rely on to supply us?

In emergency disaster planning, if we can predict natural as well as manmade disasters that occur solely in our country or cross national borders—for example, crop freezes or pestilence or acid rain or earthquakes or floods or droughts—then we ought to be able to prepare for these emergencies and to respond to them, to contain them, and to limit losses.

In immigration policy, what do the population growth rates of many lesser developed countries, coupled with their other natural, economic, social, and political resources tell us about the numbers of people and the times at which they may seek to enter the United States, either temporarily or permanently?

Retirement policy is an excellent example. What would long-range projections of the U.S. population size and age tell us about demands on the Social Security System? Perhaps if we had exercised a little greater foresight a few years ago, Social Security could be a sounder system today.

International lending—if we can quantify the interdependence of the economies of the Third World countries, are we not in a better position to make lending decisions with respect to these economies?

Technology transfer, scientific exchange—if we know the areas in which we, as well as our allies, need to improve our productivity or substitute a resource, could this not guide our decisions on which technologies to share with others, and at what point should we share those technologies?

These are just some of the policy areas in which a global foresight capacity might aid us in making informed decisions about the future.

Two years ago, in testimony before the Subcommittee on International Economic Policy of the Senate Committee on Foreign Relations, John Gibbons, Director of the Office of Technology Assessment, had this to say:

> For most of our history, the resources and isolation of the United States have shielded us from the miseries experienced elsewhere on the globe, but it would be impossible for us to escape the consequences of global changes of such magnitude as I have mentioned. Our access to key resources and markets for our products could be restricted, and widespread hunger elsewhere in the world could place unprecedented stress on marginal United States agricultural lands * * *. I am personally optimistic about the ability of human resourcefulness to solve big problems if they are recognized in time, but I am not convinced that our past methods of analysis will be sufficient to the issues of the present and the future.

I share John Gibbons' optimism about the ability of man to adapt and change by confronting problems before they reach crisis proportions.

We can very ill afford as a nation to be blind-sided by unanticipated events such as the Arab oil embargo of 1973. Nor can we continue to just muddle along and through problems of far-reaching proportions. Nor can we simply adopt a Pollyanna attitude toward the seriousness and dimensions of many world problems.

It was all very well for Scarlett O'Hara to say, "I'll worry about that tomorrow," but that is certain to ensure that we will, in fact, someday be gone with the wind.

I would like to yield now to the distinguished Senator from Vermont, Senator Stafford.

Senator STAFFORD. Thank you very much, Senator Mathias. I do not——

Senator MATHIAS. Perhaps I should give him the gavel as the cochairman of this event.

Senator STAFFORD. No; you keep the gavel. I am very glad to be here. I have no opening statement. It has, on occasion, occurred to me that there are elements in our society who think about the environment, and using the paraphrased words of Rhett Butler from "Gone With The Wind," say: "Frankly, my country, I don't give a damn."

We do, and that's why I am here. I look forward to hearing the witnesses.

Thank you very much.

Senator MATHIAS. Our first distinguished witness is the Senator from Tennessee, Mr. Gore.

TESTIMONY OF HON. ALBERT GORE, JR., U.S. SENATOR FROM THE STATE OF TENNESSEE

Senator GORE. Thank you, Mr. Chairman, and Mr. Chairman, I want to applaud both of you for taking the time to study this very important issue. The future is something that Congress too rarely deals with in depth.

We often lurch from one crisis to another. Meanwhile, new problems bubble beneath the surface for years and we barely recognize them in our preoccupation with the present day's crisis. Then, suddenly, they burst forth, whether it is Social Security funding or energy supplies or prices, or trade imbalances, or whatever.

For example, we thought for years that the Earth contained inexhaustible resources that could cope with whatever abuses we heaped on it or into it. We have since discovered problems like the enormous quantity of toxic wastes oozing into our water supplies. We learned about soil erosion and later about finite fossil fuel resources.

Our Nation's energy picture was wrenched first by lower supplies, then by higher prices. Demand eventually dropped and we were sent reeling by having to pay for many nuclear power plants we no longer needed.

Another example—as baby boomers matured and entered the working world, school enrollment dropped, and we had abandoned school buildings all over the country. Now the baby boomers are having children of their own, and we find a shortage of elementary school teachers that we could have anticipated but didn't.

One year we infused money into the Nation's railway system, and then another year we debated ending our rail subsidy by shutting down the system.

And these examples are only the tip of the iceberg.

Sometimes when we try to glimpse into the future, we get more confused than when we started. For example, computer models in executive agencies often develop conclusions that are widely inconsistent with one another, and indeed, the programs on which these computers run are not congruent with one another. Our shortsightedness does not necessarily result from the fact that we aren't doing enough studies or collecting enough information because from the Census Bureau to the Social Security Administration, the Federal Government often seems awash in facts and data and statistics.

But what are we doing with these facts? How are we, as elected leaders, assessing today the critical trends that tomorrow will become crises and the day after require our immediate response?

It is precisely because we are often so institutionally shortsighted that I am today introducing legislation that would provide for the continuous assessment of critical trends and alternative futures. It is very similar to a bill I introduced in the House 2 years ago. Unfortunately, that bill didn't get very far, but I found after doing some research that that is not unusual for efforts of this kind.

For example, shortly after this century began, President Theodore Roosevelt created a national commission to study the future of our country's natural resources. The group met with congressional opposition and eventually it just wilted. I wish that it had been more successful.

Let me speak for a moment about this piece of legislation. The Critical Trends Assessment Act would not constitute Government by commission. The office it would create would not usurp powers from any Federal agency. It would not be a method to invoke centralized planning into the Federal Government. I invite you to study the bill carefully. The word "planning" never appears, and the office would not be, I hope, the sole source for thinking about the future in the Government.

I envision it as a coordinator, an instigator, a facilitator, for those of us in Government and in the public at large who believe that present day trends deserve more than a seat-of-the-pants reaction. I see the office as a mechanism to encourage useful debate among people in the Federal Government as well as in the private sector, focusing our attention beyond immediate concerns, and making us better prepared for the future.

Specifically, the bill would establish within the Executive Office of the President an Office of Critical Trends Analysis, with a $5 million annual budget. The office would be authorized to advise the President, "of the potential effect of Government policies on critical trends and alternative futures."

The office would produce, every 4 years, an "Executive Branch Report on Critical Trends and Alternative Futures." The Joint Economic Committee of Congress would produce a similar report with its own findings every 2 years.

Both reports would be expected to identify and analyze critical trends and alternative futures for the next 20 years in light of economic, technological, political, environmental, demographic and social causes and consequences. They would analyze these trends based on current conditions, evaluate current Government policies, and consider any alternative approaches.

An Advisory Commission on Critical Trends Analysis would be created with executive, congressional, and private sector representation. The advisory commission would assist the office and promote public discussion of critical trends.

I personally have seen the value of getting Congress to look into the future. About 2 years ago the Congressional Clearinghouse on the Future, which I chaired for 4 years up until 2 years ago, published a "Future Agenda" as seen by the committees and subcommittees of the House of Representatives. We went and got every subcommittee of the House to sit down, majority and minority, and prepare a list of those issues that they could anticipate having to deal with over the next 20 years. We then compiled that according to subcommittee jurisdiction and widely disseminated it within the private sector, particularly in the academic community, and asked for comments back to the subcommittees. We had hoped that this would become a regular exercise and that foresight hearings might even be institutionalized to bring people from the private sector in to analyze and critique the future agenda of each subcommittee, but that has not yet occurred. I still believe that it is something that should be pursued, and perhaps the Senate could succeed where the House did not follow through on that.

It was a valuable exercise, in any event, in getting the committees to focus beyond the day-to-day concerns and look at long-term trends.

I know that you have also worked to instill greater governmental foresight, Mr. Chairman, and Mr. Chairman, and that today's hearing is just one indication of the interest the two of you have had. I would like to work very closely with you on this matter to achieve a broad, bipartisan consensus on how we might improve governmental foresight. I see the piece of legislation that I am introducing today as one starting point for discussions, and I am extremely interested in any suggestions that the two of you might have, and hope that I can work closely with you.

In closing, let me say that we know land fueled the agricultural revolution and capital fueled the industrial revolution. There is a growing awareness that information is fueling our present revolution. But what are we doing with it? We are gathering data, we are making studies, and we are shoving much of it aside so we can handle the crises of the present.

I believe that Congress and the executive branch can show more foresight than that. Thank you.

Senator MATHIAS. Thank you very much, Senator Gore.

Senator Stafford, do you have some questions?

Senator STAFFORD. That was a very good statement. I do not have any questions. I am impressed with Senator Gore's statement and his knowledge of what we really ought to be doing.

Senator MATHIAS. I might just pursue for a moment the question, the method, of how we develop some foresight capability. An example which you and Senator Stafford and I, also, all have some common experience with is the way we gain some foresight about our own political fortunes. As you know, taking a poll is the classic method of doing it. But is one poll enough? Or do you need to go back and take a series of polls updating your polling base? In other words, you establish a data base, in effect, by your first poll. But is it not true, then, that you have to continue to poll to see where the directions are taking you, whether you are going up or down, whether some issues are gaining and losing. Isn't that the basic method that you apply to a lot of this foresight capability?

Senator GORE. That is a very incisive comment, and an analogy that I think our colleagues will find easy to understand. Indeed, if you just take one poll in a political campaign, and take a snapshot of the opinions and attitudes of the electorate as of that moment in time, it becomes a depreciating asset very, very quickly. The second poll you do, by contrast, is not just a snapshot. It provides you a way to triangulate and observe the trends within the attitudes of the electorate, and you can observe the direction in which they are moving. The third, fourth, and fifth poll can bring into view a pattern of movement in a whole range of issues. In a similar way, if the Government, instead of just having a study of a problem and then pushing it aside and making policy on it and then forgetting about it, if instead the Government in an institutional way had a regular updating of analyzing these trends, we would be able to see much more clearly what patterns were developing, what trends were occurring, and we would be able to better anticipate problems before they become crises.

Senator MATHIAS. And of course the Government's capacity to make projections of this kind would be greater than a political pollster's because the political pollster is only taking a sample, and he is taking a sample of a subjective nature. What are people thinking at that moment?

Senator GORE. Right.

Senator MATHIAS. Whereas Government projections can be made on the basis of objective fact which is reported statistically and comprehensively.

Senator **Gore**. I couldn't agree more, and the very act of trying to look beyond the horizon is very useful in and of itself, and I think the executive branch ought to be required to do more of it, and we here in the Congress ought to be required to do more of it.

Senator **Mathias**. It is particularly valuable, it seems to me, because it may not always tell you what you should do, but it very nearly will always tell you what you should not do.

Senator **Gore**. I agree with that comment as well.

Senator **Mathias**. We thank you very much for leading off this hearing this morning.

Senator **Gore**. Thank you, Mr. Chairman.

Senator **Mathias**. Our next witness will be Mr. Alan Hill, the Chairman of the Council on Environmental Quality.

Mr. Hill, we are glad to welcome you here this morning.

Mr. **Hill**. Good morning, Mr. Chairman and Mr. Chairman.

Senator **Stafford**. Good morning.

Mr. **Hill**. I appreciate the invitation to appear before you today to discuss your concerns and mine regarding the subject of this hearing: Global foresight capability of the U.S. Government.

I have a full statement which answers in detail the questions posed to me by this committee which I will submit for the record, and will present a summary of that statement at this time.

Senator **Mathias**. Without objection, we will insert your prepared remarks in the record.

TESTIMONY OF A. ALAN HILL, CHAIRMAN, COUNCIL ON ENVIRONMENTAL QUALITY, EXECUTIVE OFFICE OF THE PRESIDENT

Mr. **Hill**. As Chairman of the President's Council on Environmental Quality, one of my responsibilities is to oversee that function of the Council which requires it to gather information on conditions and trends in the quality of the environment, both current and prospective. In this regard, I serve as Chairman of the Global Issues Working Group which was established by CEQ at the request of the President in September 1981.

The Global Issues Working Group has reported to the Cabinet Council on Natural Resources and Environment since then for guidance and direction as appropriate, and will continue this relationship with the newly created Cabinet Council for Domestic Policy.

Currently, CEQ is fulfilling its mandate of coordinating Federal agency international environmental activities by overseeing the development of the U.S. response to the United Nations Economic Commission for Europe [ECE] request for a national review of environmental policies and strategies, and by developing issue papers representing U.S. positions on environmental data and monitoring and the state of the environment for the United Nations Environmental Program [UNEP] Governing Council session which is scheduled for next month.

During 1984 the Global Issues Working Group was substantially responsible for the following:

First, publication of a report in May 1984, on "Corporate Use of Information Regarding Natural Resources and Environmental

Quality," by Russell Train, the president of the World Wildlife Fund, for CEQ.

Next, publication of a reference manual in November 1984 as a followup to the World Wildlife Fund report, entitled "Gaining Access to United States Government Information on the Environment and Natural Resources." This was prepared by the Department of Energy and the Council.

And finally, publication of an updated inventory entitled "U.S. Government Participation in International Treaties, Agreements, Organizations, and Programs in the Fields of Environment, Natural Resources and Population." This was prepared for us by the Department of State.

In regard to the followup work on CEQ's previous products, the Council continues to be involved in several activities designed to improve Government forecasting capabilities. One of the recommendations of the report "Corporate Use of Information Regarding Natural Resources and Environmental Quality" is for improvement in the Federal Government's resource-information services, which is a major prerequisite for improved Government forecasting.

The Council responded to the recommendations made in that report by publishing the document "Gaining Access to U.S. Government Information on the Environment and Natural Resources." Additionally, in March of this year, we published a CEQ-sponsored report on "Long-Term Environmental Research and Development." Both publications serve to underline the need for improvements in our system of monitoring and data gathering. The Council's activities will continue to place emphasis on the identification and development of indicators of environmental quality for which standardized and coordinated methods of monitoring and data gathering can be implemented.

The broad term "global forecasting" describes a mechanism used to project generalized trends which are of limited utility to decisionmakers due to the inadequacy of techniques for projecting such expansive conclusions. Forecasts from models can be useful to agency and corporate heads if, and only if, all assumptions regarding the model are clearly understood; if the forecasts are not overly general and the model is used for the purpose for which it is specifically designed.

Models must be developed and operated by personnel who are experts and experienced in the field and should not project forecasts too far into the future. In regard to improving private sector cooperation with the Government in data sharing and forecasting, CEQ and the Global Issues Working Group have engaged in two specific projects which I have previously described—the World Wildlife Fund report, which recommended the Government should improve the credibility of its forecasting in the area of natural resources: First, by providing for more private sector expertise being incorporated in natural resource forecasts; and, second, the documentation of all data assumptions and methodologies which should accompany those forecasts.

The second project is by the Department of Energy and the Council, relating to access to Government information. One private sector organization, Meade Data Central, is now developing a global natural resources/environment data base which will be made available next year for electronic transfer.

The global environmental principles developed by the working group advance the concept that effective environmental protection and wise resource use on a global basis will not occur unless economic and social progress takes place as well, providing the opportunity and resources for environmental progress. Obviously, wise use of the Earth's natural resource base and protection of the global environment are desirable ends, and the principles state that those ends are not going to be achieved unless countries prosper and consequently have the opportunity to devote resources toward those ends.

I have made reference to the need for improvement in environmental monitoring and gathering of data and the usefulness of information generated. Often, forecasts of trends are made grounded upon frequently changing data bases. Such is the case with the sector trends identified in "The Global 2000 Report to the President: The Technical Report: Volume Two." For example, modifications in the data bases previously used for this report show a current trend toward a more optimistic scenario for the year 2000. Global energy use and, consequently, energy prices, have been substantially below Global 2000 projected levels. Subsequently, world food prices, which were projected in Global 2000 to increase in significant part as a result of a rise in petroleum dependence, are evidence of a variation of earlier predicted trends. In addition global population growth is significantly lower now than projected by Global 2000.

This is not to say that these and other trends were incorrectly identified. It does serve, though, to emphasize the fact that the fast pace of improvements in scientific technology and research will impact heavily on the data base upon which trends are based. The perspective paper the Council on Environmental Quality and the Global Issues Working Group is developing will give us a more current global outlook.

I believe that, for the future, mankind will generally be better off both socially and economically due to our ingenuity and innovative technology. As our knowledge and insight grow, we may face new challenges to our environment and natural resources. We will succeed in meeting those chalenges with improved data and techniques. The Council on Environmental Quality is working for that progress.

Mr. Chairman, this concludes my prepared statement. I would be pleased to answer any questions.

Senator MATHIAS. Senator Stafford.

Senator STAFFORD. Thank you very much, Senator Mathias. Mr. Hill, are you a lawyer, by chance, as so many of us are here?

Mr. HILL. I am not. Not guilty, Mr. Chairman.

Senator MATHIAS. You may be fortunate. Remember Dr. Johnson used to say that he was reluctant to speak ill of any man, but he is a lawyer. [Laughter.]

Senator STAFFORD Well, Mr. Hill, I once was a lawyer. It has been a long time since I practiced, but I am constantly reminded in dealing with problems in front of the Senate that in our judicial system, there are two levels of proof. In civil cases the prevailing party needs to prevail by a fair preponderance of the evidence, and in criminal cases the State must prove its case beyond a reasonable doubt. It has often seemed to me that when a problem has been met, established beyond a reasonable doubt, and the need for action has been indicated beyond a reasonable doubt, that the time to act has arrived. That is simply a statement of my feeling about some of the issues that we face here in the Congress on behalf of the American people.

I am interested in global forecasting, in part, because it could help us avoid human, environmental, and natural resource catastrophes. These could include a range of events from acid rain in North America and Europe to famine in Africa. What specific action is the Council on Environmental Quality taking to predict the consequences of the following? First, the greenhouse effect. Second, ozone layer depletion. And third, soils and forest effects of acid rain and other transported air pollutants. Specifically, how much money and how many persons are working on these projections?

Mr. HILL. Mr. Chairman, it would be very difficult, to answer the last part first, to estimate the amount of resources being devoted. As I noted, the Council chairs the Global Issues Working Group, which consists of more than 20 agencies that are listed in my written response.

We have focused on, and are continuing to focus on, what we refer to as a perspective paper which would be our administration drawing together—drawing together our administration's perspective with regard to global environment and natural resources issues. Behind that will come a set of issue papers, tentatively titled, in which there is a specific visitation of topical questions. One section, for instance, would refer to atmospheric issues. We are trying to get the perspective paper done first, and I must say, achieving consensus among 20-plus agencies is not an easy task.

Before we proceed now on the matter of consensus on the perspective paper I want to say that a lot of staff work has gone in to prepare the basic material for those issue-related papers. However, we are proceeding first with perspective paper; second, with the issue papers; and then we will be into the area of forecasting.

Senator STAFFORD. All right. Thank you. Senator Mathias.

Senator MATHIAS. Well, I was interested that you said that models should not project forecasts too far into the future, and I suppose that is obviously true from subject to subject, but a question arises, really, as to what you think too far is. How do you judge what is too far on a given subject?

Mr. HILL. It is very difficult, Mr. Chairman, to project out 20 or 30 years in most areas. We have a couple of issues that turned up in the study that Russell Train did for the Council: that is, we were interested in how data produced by the Federal Government is viewed by the private sector. Mr. Train and his staff interviewed some 200 decisionmakers at various levels and also corporations that use these data. One of the major recommendations that flowed from this report is a proposal to provide the opportunity to illuminate the assumptions in any model so that all decisionmakers understand what is in, and what is driving, that model.

I think the same conclusion was drawn in the General Accounting Office report of 1982, as I recall, with regard to models in the Federal Government.

There is a need for quality data in the data base on which that model is built, so we have those difficulties. Surely with a 1- or 2-year projection, you are on much more firm ground. Trends do change.

Senator **Mathias**. Of course, this depends on the subject, doesn't it?

Mr. **Hill**. Yes, it certainly does.

Senator **Mathias**. Now, a 20- or 30-year projection of the number of people in the country over age 65 would be fairly dependable.

Mr. **Hill**. Yes.

Senator **Mathias**. That depends on facts that are within our grasp. I would agree with you that a 20- or 30-year projection of, say, oil consumption, which depends on a number of variables, would be less dependable.

Mr. **Hill**. Yes.

Senator **Mathias**. So we need to make those kinds of judgments which you indicate in your statement—I think as you said it, you have to understand the assumptions.

Mr. **Hill**. Yes.

Senator **Stafford**. If the Senator would yield, a 2-year projection on the part of our friends on the other side of the aisle that they are going to control the Senate in 1986 might not be very reliable, either. [Laughter.]

Senator **Mathias**. There are a number of variables that are involved there that would make any projection of that sort uncertain.

So there are some projections that can be extremely dependable, some that are less so.

Mr. **Hill**. Early in this century President Theodore Roosevelt predicted the loss of our forest resources, and we know that that has not come true. Now, what has been applied to that has been mankind's intelligence. We have made informed choices and decisions.

Senator **Mathias**. Well, isn't that exactly what we are talking about?

Mr. **Hill**. Yes.

Senator **Mathias**. President Theodore Roosevelt was probably accurate in his prediction based on the assumption that the current practices would continue.

Mr. **Hill**. Yes.

Senator **Mathias**. And that is really—you put your finger on the importance of making these projections. If we continue to do what we are doing, X, Y, and Z will occur. And so, then, reasonably prudent and common sense human beings change what they are doing.

Mr. **Hill**. Well, as Senator Stafford is aware, at the Council we are working on a very difficult issue regarding worst case analysis dealing with low probability, high impact consequences of proposed actions. It is a reasonable assumption, for instance, when one considers the tragedy at Bhopal, that if a physical plant is not maintained and the staff is not well trained in safety procedures, it is reasonable to project that there will be a tragedy. However, if the reverse is the case, it is reasonable to project that the plant will operate properly. And it is the use of informed decisionmaking and a reasonable approach that is the key to this situation.

Senator **Mathias**. Now, you referred to private use of these projections. What do you see as the proper governmental use of these projections?

Mr. **Hill**. I think the Government produces an unbelievable amount of data, and that was the reason——

Senator **Mathias**. In fact, it may even be the principal business of government to produce data.

Mr. **Hill**. Yes. In some cases. The data are used by our private sector to guide its investment trade activities, and so forth. What we found in reviewing the report is, as I said, the need for visibility of the assumptions and a very heavy demand for more timely exchange of data. We are entering an era when electronic transfer of data is actually with us. The Federal Government, in most cases, does not provide for that. There are examples of these users of data. The largest bakery, for instance, on the east coast, relies on the projection of global grain production to schedule its purchases, and it makes a difference of 1 or 2 cents per loaf of bread in Washington, DC, for example. So, those data do have uses.

Senator **Mathias**. Well, shouldn't they have equal governmental uses? For example, wasn't it a prudent decision for the United States to embargo the sale of grain in response to the Russians' invasion of Afghanistan when we should have known that that would trigger the plowing of virgin lands in Brazil for soybeans which are now a major competitor in the market for that crop and trigger the increase in production of grain in Argentina, making that country a still greater competitor for grain markets. Weren't those things foreseeable? Shouldn't we have projected that as an almost inevitable result?

Mr. **Hill**. I was not involved in the Government at the time, and I——

Senator **Mathias**. You can give us an objective answer, then.

Mr. **Hill**. I don't want to hazard a forecast on that one.

Senator **Mathias**. Well, that is not a forecast. That is retrospective.

Mr. **Hill**. Well——

Senator **Mathias**. You still don't want to answer?

Mr. **Hill**. I lack the information, Mr. Chairman.

Senator **Mathias**. You indicated that the Global Issues Working Group has been developing a perspective paper on international environment since 1983.

Mr. **Hill**. Yes.

Senator **Mathias**. For whom is this paper?

Mr. **Hill**. It will be presented to the Cabinet Council, and the Cabinet Council will accept, modify, or reject, and decide further uses for it.

Senator **Mathias**. Will it be made available for public comment?

Mr. **Hill**. That is a decision the Cabinet Council will have to make. I would hope so.

Senator **Mathias**. Can you give us any idea as to when this will take place?

Mr. **Hill**. As I indicated in my remarks, we are trying to achieve a major degree of consensus among very disparate agencies, and therein lies the difficulty. I think we are now at the point where our draft outline is fairly acceptable to all the involved agencies.

Senator **Mathias**. Does this mean that the Council is trying to improve the quality and timeliness of Government data?

Mr. **Hill**. That will follow on.

Senator **Mathias**. We hope.

Mr. **Hill**. We have another project underway, Mr. Chairman, on improving our system of monitoring across the Federal Government. It is an issue that came up in the World Wildlife Fund report and in our later conference of experts on long-term research needs. We have out now a proposed cooperative work plan with other agencies in the Federal Government, trying to gather the resources—both dollarwise and manpowerwise, to carry on that project. This is another step in improving the quality of our data base.

Senator **Mathias**. This monitoring that you mentioned, is this both private uses and Government uses of the data?

Mr. **Hill**. This would be just within the Government. As an example, Mr. Chairman, there is no central inventory of all of the monitoring programs performed by the Federal Government, and we feel that is a fairly good first step. I did refer in my formal remarks, for instance, to the inventory of our international agreements with regard to the environment and natural resources. Until the Global Issues Working Group requested that, such an inventory had not been prepared. It is now and is a very useful document.

Senator **Mathias**. It is useful if it is used. Is there an analysis made of it?

Mr. **Hill**. We have requests every week for copies of it. What it has done is help provide a coordination mechanism with regard to these agreements.

Senator **Mathias**. Thank you very much, Mr. Hill.

Senator Humphrey.

Senator **Humphrey**. No.

Senator **Mathias**. Senator Abdnor.

Senator **Abdnor**. No.

Senator **Mathias**. Would you be willing to respond to some questions in writing——

Mr. **Hill**. Oh, surely.

Senator **Mathias** [continuing]. Which might flow from this, and we will make that a part of the record, without objection.

Mr. **Hill**. Surely.

Senator **Mathias**. Thank you very much.

[Mr. Hill's prepared statement and responses to written questions follow:]

PREPARED STATEMENT OF A. ALAN HILL

Good morning Mr. Chairman and Members of the Committee. Thank you for inviting me to appear before you today to discuss your concerns and mine regarding the subject of this hearing "Global Forecasting Capability of the U.S. Government."

I have a full statement which answers in detail the questions posed to me by this Committee, which I will submit for the record, and will present a summary of that statement at this time.

As Chairman of the President's Council on Environmental Quality one of my responsibilities is to oversee that function of the Council which requires it to gather information on "conditions and trends in the quality of the environment both current and prospective. . ." In this regard, I serve as Chairman of the Global Issues Working Group, which was established by CEQ at the request of the President in September 1981. The Global Issues Working Group has reported to the Cabinet Council on Natural Resources and Environment since then for guidance and direction as appropriate and will continue this relationship with the newly created Cabinet Council for Domestic Policy.

During 1982-84 the working group has held ten formal meetings. However, the majority of the business of the Working Group is conducted through considerably more frequent meetings and communications with representatives of the Working Group members, and through continuing staff activity at the agencies which comprise the Working Group. Membership of the Global Issues Working Group consists of senior level policy representatives of the following agencies: Council on Environmental Quality, OMB, Council of Economic Advisors, National Security Council, Office of Policy Development, Office of Science & Technology Policy, Department of State, EPA, AID, Federal Emergency Management Agency, NOAA, Department of Agriculture, Department of Justice, HHS, HUD, NASA, Department of Interior, National Science Foundation, and the Department of Energy.

In my capacity as a member of the Cabinet Council on Natural Resources and Environment, I have informally brought to the attention of the Cabinet Council policy issues representing the view of or emanating from the Global Issues Working Group. The Cabinet Council approved the Global Environmental Principles which were developed by the Working Group. These Principles were presented to the United Nations Environmental Program special session held in Nairobi, Kenya, in May 1982, and officially represented the U.S. position. The Principles were provided to this Committee in my previous testimony June 23, 1982. In addition, the Working Group sought formal guidance in 1983 from the Cabinet Council as to procedures to follow regarding the ongoing work of the Working Group on an international perspective paper and various issue papers. The Cabinet Council agreed that these projects should continue.

The Perspective Paper on International Environmental Issues which I mentioned is a primary goal of the Global Issues Working Group for 1985. Substantial progress has aleady been made by the Working Group member agencies on various international environmental issue papers to formulate and articulate a perspective which fairly represents a consensus of existing viewpoints. Needless to say, achieving a consensus this is an arduous and time-consuming task. I am, however, personally committed to our reaching accord so that our progress in this area can continue.

Currently, CEQ is fulfilling its mandate of coordinating Federal agency international environmental activities by overseeing the development of the U.S. response to the United Nations Economic Commission for Europe (ECE) request for a "National Review of Environmental Policies and Strategies", and by developing issue papers representing U.S. positions on

"Environmental Data and Monitoring" and the "State of the Environment" for the United Nations Environmental Program (UNEP) governing council session scheduled for next month.

During 1984 the Global Issues Working Group was substantially responsible for the following:

- Publication of a report in May, 1984 on "Corporate Use of Information Regarding Natural Resources and Environmental Quality" by the World Wildlife Fund for the Council on Environmental Quality.

- Publication of a reference manual in November, 1984 as a follow-up to the WWF report titled "Gaining Access to U.S. Government Information on the Environment and Natural Resources by the U.S. Department of Energy and the Council on Environmental Quality.

- Publication of an updated inventory entitled "U.S. Government Participation in International Treaties, Agreements, Organizations, and Programs in the Fields of Environment, Natural Resources and Population," prepared by the Department of State for the Global Issues Working Group.

In regard to follow-up work on CEQ's previous products, the Council continues to be involved in several activities designed to improve government forecasting capabilities. One of the recommendations of the report "Corporate Use of Information Regarding Natural Resources and Environmental Quality" is for improvement in the Federal Govenment's resource-information services, which is a major prerequisite for improved government forecasting.

During the past fiscal year, the Council developed a plan to begin an interagency effort to update information on data sources that are available, and to cooperatively develop and implement a series of work plans to bring about the resolution of known environmental monitoring problems. All of these activities are intended to enhance the forecasting capabilities of the U.S. Government.

The inventory prepared for the Global Issues Working Group by the Department of State titled "U.S. Government in International Treaties Agreeements, Organizations, and Programs in the Fields of Environment, Natural Resources and Population" indicated the breadth and depth of U.S. involvement in international environmental activities. The substantial degree of involvement shown, further suggested the need for improved coordination among the involved agencies. Consequently, we have made this inventory available to all concerned agencies and interested parties and have continued our work to improve coordination and communication on international activities.

The Council responded to the recommendations made in the report "Corporate Use of Information Regarding Natural Resources and Environmental Quality", by publishing the document "Gaining Access to U.S. Government Information on the Environment and Natural Resources." Additionally, in March of this year we published a CEQ-sponsored report on "Long-Term Environmental Research and Development." Both publications serve to underline the need for improvements in our system of monitoring and gathering data. The Council's activities will continue to place emphasis on the identification and development of indicators of environmental quality for which standardized and coordinated methods of monitoring and data gathering can be implemented.

The broad term "global forecasting" describes a mechanism used to project generalized trends which are of limited utility to decision-makers due to the inadequacy of techniques for projecting such expansive conclusions. Forecasts from models can be useful to agency and corporate heads if, and only if, all assumptions regarding the model are clearly understood; if the forecasts are not overly general and the model is used for the purpose for which it is specifically designed. Models must be developed and operated by personnel who are expert and experienced in the field and should not project forecasts too far into the future. In regard to improving private sector cooperation with the government in data-sharing and forecasting, CEQ and the Global Issues Working Group have engaged in two specific projects which I have previously described - the World Wildlife Fund report which recommended, "the government should improve the credibility of its forecasting in the area of natural resources.

- More private-sector expertise should be incorporated in natural resource forecasts.

- Documentation of all data assumptions and methodologies should accompany forecasts."

and, the second project, by the Department of Energy and the Council relating to access to government information. One private sector orgainization, Meade Data Central, is now developing a global natural resources/environment data base which will be available next year for electronic transfer.

The Global Environmental Pricinples developed by the Global Issues Working Group advance the concept that effective environmental protection and wise resource use on a global basis will not occur unless economic and social progress takes place as well, providing the opportunity and resources for environmental progress. Obviously, wise use of the earth's natural resource base and protection of the global environment are desirable ends, and the Principle states that those ends are not going to be achieved unless countries prosper and consequently have the opportunity to devote resources towards those ends.

Of importance to the promotion of U.S. international environmental policy objectives is the Perspective paper currently being developed by the Global Issues Working Group. It is necessary, however, to have a consensus of opinion among the many agencies within the Administration before we can adequately discuss the Perspective paper and develop a coordinated set of international environmental goals which our government hopes to achieve.

I have made reference to the need for improvement in environmental monitoring and gathering of data and the usefulness of information generated. Often, forecasts of trends are made grounded upon frequently-changing data bases. Such is the case with the sector trends identified in "The Global 2000 Report to the President: The Technical Report: Volume Two." For example, modifications in the data bases previously used for this report show a current trend towards a more optimistic scenario for the year 2000. Global energy use and, consequently, energy prices, have been substantially below Global 2000 projected levels. Subsequently, world food prices, which were projected in Global 2000 to increase in significant part as a result of a rise in petroleum dependence, are evidence of a variation of earlier predicted trends. In addition, global population growth is significantly lower now than projected by Global 2000.

This is not to say that these and other trends were incorrectly identified. It does serve, though, to emphasize the fact that the fast pace of improvements in scientific technology and research will impact heavily on the data bases upon which trends are based. The Perspective Paper the Council on Environmental Quality and the Global Issues Working Group are developing will give us a more current global outlook.

I believe that, for the future, mankind will generally be better off both socially and economically due to our ingenuity and innovative technology. As our knowledge and insight grow, we may face new challenges to our environment and natural resources. We will succeed in meeting these challenges with improved data and techniques. The Council on Environmental Quality is working for that progress.

Mr. Chairman, this concludes my prepared statement. I would be pleased to answer any questions the Committee might have.

(Note: Attached are detailed answers to the questions posed by the Committee to Chairman Hill).

APRIL 30, 1985

Q1. GLOBAL ISSUES WORKING GROUP (GIWG)

Q. 1985 Agenda

A. The GIWG has focused on development of a Perspective Paper on International Environmental Issues as a primary goal for 1985. Substantial work, done during 1984 by GIWG member agencies on various international environmental issue papers, reaffirmed the need for such a Perspective Paper to provide consistency of philosophy and approach for issue papers. Forming and articulating a perspective which fairly represents a consensus of existing viewpoints is an arduous and a time consuming task; however, substantial progress has been made.

Currently, the GIWG is fulfilling its mandate of coordinating Federal agency international environmental activities by overseeing the development of the U.S. response to the United Nations Economic Commission for Europe (ECE) request for a "National Review of Environmental Policies and Strategies", and by developing issue papers representing U.S. positions on "Environmental Data and Monitoring" and the "State of the Environment" to the United Nations Environmental Program (UNEP) governing council session.

Q. 1984 Accomplishments

A. In addition to ongoing work by member agencies on international environmental issue papers and coordination of input from member agencies to international organizations such as UNEP, OECD, ECE, etc.), GIWG was substantially responsible for the following in 1984:

- Publication of a report in May 1984 on "Corporate Use of Information Regarding Natural Resources and Environmental Quality" by the World Wildlife Fund (WWF) for the Council on Environmental Quality.
- Publication of a reference manual in November 1984 as a follow-up to the WWF report titled "Gaining Access to U.S. Government Information on the Environment and Natural Resources" by the U.S. Department of Energy and the Council on Environmental Quality.
- Preparation of an updated inventory entitled "U.S. Government Participation in International Treaties, Agreements, Organizations, and Programs in the Fields of Environment, Natural Resources and Population," prepared by the Department of State for the Global Issues Working Group.

Q. Frequency of Meetings and Agences Represented

A. The GIWG met formally ten times during 1982-1984, including two meetings in 1984. Considerably more ad hoc meetings were held by representatives of the Working Group members during this period. The GIWG consists of senior level policy representatives of the following agencies: Council on Environmental Quality, Office of Management and Budget, Council on Economic Advisors, National Security Council, Office of Policy Development, Office of Science & Technology Policy, Department of State, Environmental Protection Agency, Agency For International Development (AID), Federal Emergency Management Agency, Department of Defense, National Oceanic and Atmospheric Administration, Department of Agriculture, Department of Energy, Department of Justice, Department of Health and Human Services, Department of Housing and Urban Development National Aeronautics and Space Administration, Department of the Interior, National Science Foundation, and the Department of Energy.

Q. Full-Time Professional Staff Assigned/Consultants and Subjects

A. CEQ coordinates the activities of GIWG through a full-time professional career SES level government employee currently on detail to CEQ from EPA. However, the work of GIWG is accomplished through the ad hoc working group committee previously mentioned, with staff support at the agencies of those ad hoc committee members.

Q. Relationship to Cabinet Council

A. The Global Issues Working Group was established at the request of the President in September 1981 by CEQ. Since that time, the GIWG has reported to the Cabinet Council on Natural Resources and Environment for guidance and direction as needed. In the future, similar guidance and direction is expected, on appropriate GIWG matters, from the newly created Cabinet Council for Domestic Policy.

Q. What policy issues have been brought to Cabinet Council by GIWG?

A. Informally, policy issues representing the view of, or emanating from, GIWG have been brought to the attention of the Cabinet Council periodically by A. Alan Hill, who serves as Chairman of the GIWG, and is a member of the Cabinet Council. More formally, the GIWG sought guidance in 1983 on whether and how to proceed with ongoing work on an international environmental perspective paper and issue papers. The Cabinet Council agreed that the work of the GIWG on the perspective and issue papers should continue.

Q. What policies have been adopted/implemented as a result of GIWG?

A. The activities of GIWG to date have focused on improved communication and coordination on international issues within the Federal and public sectors, in part by developing studies and information resources. This improved communication and coordination through GIWG has resulted in progress towards a consensus among Federal agencies on a number of international environmental issues. Specifically, GIWG policy is most evident in the Global Environmental Principles presented by the United States to the United Nations in Nairobi in May 1982.

Q2. FOLLOW-UP TO 1982 WORK PRODUCTS OF CEQ

Q. In testimony before the Senate Foreign Relations Committee, Subcommittee on International Economic Policy on June 23, 1981, Mr. Hill described the limitations of modeling and fecasting. He referred to a study commissioned by CEQ by Gerald Barney addressing means to improve government forecasting capabilities.

Q. What follow-up has been undertaken at CEQ and in other agencies in response to that paper?

A. CEQ was and is engaged in several major activities designed to improve government forecasting capabilities. One of these activities was the 1984 World Wildlife Fund report on "Corporate Use of Information Regarding Natural Resources and Environmental Quality". A purpose of that report was "to recommend improvements to the Federal Government's resource-information services" which is a primary prerequisite for improved government forecasting.

In FY 1984, the Council began a new cycle of activity related to the improvement of environmental monitoring and data. A plan was developed to initiate an interagency effort to update information or data sources that are available, and to cooperatively develop and implement a series of work plans to bring about the resolution of known environmental monitoring problems. The interagency working group will be established in FY 1985. Early accomplishments are expected to be the identification of environmental indicators necessary for adequate reporting of environmental quality and environmental health, identification of important government and private sector sources for such information, and the initial organization of environmental trends information.

Q. Mr. Hill also described an inventory of U.S. international bi-lateral and multi-lateral treaties by a consultant to CEQ.

What did that inventory tell CEQ?

What actions have you/do you plan to take as a result of what you learned from that inventory?

A. The inventory entitled "U.S. Government Participation in International Treaties Agreements, Organizations, and Programs in the Fields of Environment, Natural Resources and Population" was prepared for the Global Issues Working Group by the Department of State. In particular, the inventory indicated the breadth and depth of U.S. involvement in international environmental activities. The need for improved coordination among the involved agencies was suggested because of this substantial involvement by a number of different agencies in complex and often interrelated issues.

Through the GIWG, the inventory has been made available to involved agencies and other interested parties. Also, the GIWG has continued to work towards improved coordination and communication on international issues as a primary objective of its ongoing activities.

Q3. FOLLOW-UP TO 1984 WORK PRODUCTS OF CEQ

Corporate Use of Information Regarding Natural Resources and Environmental Quality

What thoughts do you have as to future steps CEQ might take in response to the recommendations made in this document, specifically, Chapter IV, Improving the Usefulness of Government Resource Information; and Strengthening Federal Statistical Policy Mangement?

We responded to the first recommendation for "The Creation of an Index of Government Resource Information" by jointly publishing with the Department of Energy in 1984 the document "Gaining Access to U.S. Government Information on the Environment and Natural Resources". Also, in March of this year, we published a CEQ sponsored report on "Long-Term Environmental Research and Development", which was initiated out of some of the same concerns which prompted the World Wildlife Fund report, and which has a number of recommendations which address in part the World Wildlife Fund (WWF) report recommendations. For example, the long-term research report recommends "that CEQ foster an evaluation by an appropriate organization of existing physical, chemical, and biological monitoring programs (and extant data associated with them) to identify and stimulate research and development on improving the quality and cost-effectiveness of monitoring programs." We are considering both sets of recommendations in developing future plans aimed at making government resource information more useful.

By the beginning of FY 1986, the Council expects to be well underway in its initiative to solve environmental monitoring problems. Emphasis will be placed on the identification and development of indicators of environmental quality for which standardized methods and coordinated data gathering can be implemented. Careful selection of key indicators can result in cost reductions for monitoring and increased cooperation among entities that monitor the indicators.

Select interagency work groups will be assembled to work on the solution of specific problems, such as the development of key indicators or the implementation of coordination mechanisms. As information sources are identified, they will be described in a format appropriate to the publication of a directory of environmental data sources. This will be an update of the source-book published in FY 1984 by CEQ and the Department of Energy. It is anticipated that subsequent revisions will be published by the private sector, using the format established under CEQ leadership.

Q4. IN PREVIOUS PUBLIC TESTIMONY, MR. HILL INDICATED HE WOULD ESTABLISH A TECHNICAL FORECASTING TEAM

Has it been established? If so, please describe mission, number of personnel, and work products to date.

A. No, it has not. The GIWG has established development of a perspective and issue papers on the international environment as the first priority. After the perspective paper is completed, the issue of forecasting will

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be revisited by the GIWG. The concept of establishing a Technical Forecasting Team still seems valid and will be pursued at that time.

Q5. INTER-PARLIAMENTARY CONFERENCE ON ENVIRONMENT - NAIROBI, KENYA, NOVEMBER 26 - DECEMBER 1, 1984

Did Mr. Hill attend? If so, describe the policy perspective he brought to the conference and how it was reflected in Conference Conclusions and Recommendations.

Was Mr. Hill asked about global forecasting at the Nairobi conference? If so, describe the kinds of questions asked.

A. No, Mr. Hill did not attend.

Q6. UTILITY OF GLOBAL FORECASTING

What are Mr. Hill's views of the utility of global forecasting to public policy and decision-makers?

A. "Global forecasts", which are used to project generalized trends such as degrading or improving the environment, are of limited utility to decisionmakers due to inadequacies in techniques for projecting to such generalized conclusions. They are also of limited utility in shaping public policy, other than the attention they focus on the issue at hand.

Forecasts from models can be very useful to decision-makers and others *if* all assumptions regarding the model are clearly stated up front, *if* the forecasts being generated are not overly general, *if* the model is used for purposes it is specifically designed for, and *if* the model is developed and operated by personnel who are expert and experienced in the field, *if* the forecasts do not project too far into the future.

Q. What does Mr. Hill believe to be the acceptance or lack of acceptance by agency heads of models in general and in forecasts based on those models?

A. Agency heads rely on models in a large number of important areas. For example, EPA depends on dispersion models to develop State Implementation Plans for Ambient Air Standards. Many agencies use projections based on Bureau of the Census figures for planning purposes and allocation of funds.

Agency heads should continue to rely on models, but only on those which are subject to the qualifications stated in the previous answer.

Q. What does Mr. Hill believe to be the acceptance or lack of acceptance by corporate decision-makers of models and forecasts based on those models? (Cite specific industry types.)

A. My knowledge of acceptance or non-acceptance of government forecasts by industry derives primarily from the WWF report which indicates substantial discontent. That report recommended that "The government should improve the credibility of its forecasting in the area of natural resources." Further, the report stated "On the basis of our interviews, U.S. corporations are clearly discontented with government forecasting in the area of natural resources; corporations request more collaboration between government and industry. Mechanisms are needed for increasing the input to government forecasts by experts outside the government. Corporate executives also want better documentation of what's behind the government's forecasting."

Q7. PRIVATE/PUBLIC DATA SHARING

What improvments in private sector cooperation with the government in data sharing and forecasting has CEQ been responsible for?

A. In 1984, CEQ, on its own and through GIWG, engaged in two specific projects which had as a goal "improvements in private sector cooperation with the government in data sharing and forecasting."

The World Wildlife Fund report entitled "Corporate Use of Information Regarding Natural Resources and Environmental Quality", prepared for CEQ, had as its purposes "(1) to identify corporate needs for resource information; (2) to assess the extent to which these needs are being met by various resource information services, including those of the Federal Government; and (3) to recommend improvements to the Federal Government's resource-information services." The report reflected the views of corporate participants only.

The second project, which was done by the Department of Energy and CEQ, was designed to respond to the recommendation of the WWF report for "The Creation of an Index of Government Research Information." This report, entitled "Gaining Access to U.S. Government Information on the Environment and Natural Resources" answered the following corporate concern expressed in the WWF report; "One of the complaints heard most often from corporate information users is the difficulty of locating government data they need; it is very frustrating to know that information exists and not know where to find it. Creating a comprehensive index to government resource information could contribute to the solution of this problem."

Q8. GLOBAL ENVIRONMENTAL PRINCIPLES

What status do these principles have? Have they been published? Circulated to agencies? to the public? advanced in international forums? Describe.

A. The Global Environmental Principles were presented to the United Nations Environmental Program special session held in celebration of the environmental decade. The Principles were delivered by Anne Burford, Administrator of the Environmental Protection Agency, in May of 1982 in Nairobi, Kenya. Consequently, they do officially represent the U.S. position. I have seen them referenced in a number of government and non-governmental documents.

Q. Who and how were they developed?

A. The Principles were developed through the GIWG.

Q. Principle #2 of those global principles (dated May 11, 1982) states:

> "Economic growth and social progress are necessary conditions for effective implementation of policies which will protect the global environment and promote wise use of the earth's natural resource base."

Q. Shouldn't that statement be the other way around?

A. The Principles advance the concept that effective environmental protection and wise resource use on a global basis will not occur unless economic and social progress takes place as well, providing the resources and opportunity for environmental progress. Obviously, wise use of the earth's natural resource base and protection of the global environment are desirable ends, and the principle states that those ends are not going to be achieved unless countries prosper and consequently have the opportunity to devote resources towards those ends. An argument can be made for turning the statement around, and this idea was essentially captured in the first principle which stated "A healthy environment is fundamental to the well-being of mankind", but this is not the concept this principle was meant to address.

Q. What was the response to these Global Environmental Principles presented by the U.S. to the U.N. Session of Special Character in May, 1982?

A. The Principles were generally well received by those countries with economic systems similar to our own. Countries with socialist-based economic systems responded much less favorably.

Q. What are the major international objectives the U.S. is seeking to achieve with respect to the environment, natural resources, and population?

The Perspective paper currently being developed by the GIWG will address U.S. international environmental policy objectives based on the Global Environmental Principles. It would be premature to discuss this paper until it represents a consensus of opinion among the many agencies within the Administration; however, substantial progress is being made toward such a consensus.

Q9. GLOBAL 2000

Mr. Hill has noted publicly that many of the present trends identified in Global 2000 have not continued. Are there any that have continued? Describe.

Were the trends incorrectly identified?

What actions has CEQ taken to update or correct the Global 2000 report?

What is the current Global 2000 outlook?

A. There are a number of changes that have occurred to the data bases that supported the sector trends identified in "The Global 2000 Report to the President: The Technical Report: Volume Two". Most of these changes tend to modify trends towards a more optimistic scenario for the year 2000. For example, global energy use, and consequently, energy prices, have been substantially below Global 2000 projected levels. This not only has a major direct economic impact, but a substantial indirect impact, as evidenced by world food prices which were projected in Global 2000 "to increase 95 percent over the 1970-2000 period, in significant part as a result of increased petroleum dependence." Another example of changing trends toward a more optimistic future is global population growth which is significantly lower now than projected by Global 2000.

However, my major concern with "trends" identified in Global 2000 is not with those contained in "The Technical Report: Volume Two", but in the "gloom and doom" way those trends are consolidated and presented as general trends in the "Major Findings and Conclusions" section of Volume One of the Global 2000 report. For example, the technical report of Global 2000 states that "The world has the capacity, both physical and economic, to produce enough food to meet substantial increases in demand through 2000." It further projects world food consumption per capita will increase 15 percent between 1970 and 2000, but that the less developed countries will have a much smaller per capita increase (but an increase nonetheless). This is translated in "Major Findings and Conclusions" section as follows. "For hundreds of millions of the desperately poor, the outlook for food and other necessities will be no better. For many it will be worse." This, to me, is definitely emphasizing the "half empty" rather than the "half full" side of the issue. A more balanced statement, using Global 2000 data, would be along the line that the world will have available for consumption 15 percent more food per person in the year 2000, but there are distribution problems that warrant serious attention.

CEQ and GIWG are developing a perspective paper and issue papers on international environmental issues. This work, along with other developments, has led me to believe the following is a reasonable outlook for mankind regarding the foreseeable future.

Mankind will generally be somewhat better off based on economic (per capita GNP, per capita availability of food, etc.) and social (increased life span, healthier lives, better educated, etc.) measures. Mankind's ingenuity and technical innovativeness will help bring this about in ways that can't be foreseen at this time. Improvement will be greatest in those countries whose economies are based on free market approaches.

Q10. STATE OF THE WORLD

Are you familiar with a recent publication, "State of the World 1985" (Worldwatch Institute), particularly Chapter 3 (Managing Freshwater Supplies); Chapter 4 (Maintaining World Fisheries); Chapter 5 (Protecting Forests from Air Pollution and Acid Rain); and Chapter 6 (Conserving Biological Diversity)?

Comment on the ideas expressed in these chapters and their compatibility with the Global Environmental Principles of the U.S.

A. I have not yet had an opportunity to read "State of the World, 1985". I am somewhat familiar with its contents from various press accounts, but would not wish to comment on the book without reading it myself.

Senator **Mathias**. Our next witness is Mr. Danny Boggs, the Deputy Secretary of the Department of Energy.

Mr. Boggs.

TESTIMONY OF DANNY BOGGS, DEPUTY SECRETARY, DEPARTMENT OF ENERGY

Mr. **Boggs**. Chairman Mathias, Chairman Stafford, and members of the committee, thank you for this opportunity to offer some thoughts concerning the issue of global forecasting and the capabilities and proper role of the Federal Government in that area.

My prepared testimony addresses four areas, and I would ask that it be submitted for the record.

Senator **Mathias**. Without objection, the full statement will be included in the record.

Mr. **Boggs**. First, common themes in public policy forecasting and what has been called global forecasting. Second, an analysis of past results and recurring problems with such forecasts. Third, specific energy issues. And fourth, some thoughts on how governments and private groups can and should make use of forecasting.

I would say that my own experience with the uses of forecasting in the study and formulation of public policy has been primarily as Deputy Secretary of Energy, and previously in my service in the White House Office of Policy Development. I have had the opportunity to deal with controversies concerning observed data and projections of likely futures in many fields.

Forecasting is neither new nor odd. In a practical sense, policy analysis is forecasting. The policymaker assesses the situation and projects likely outcomes if present policies continue. Other policies are explored with their respective projected problems and outcomes. If the results of one of these alternative courses is judged to be more appealing, presumably including principles as well as simply numbers, then that policy is likely to win out.

In today's hearing I have noted that the word "foresight" has been used more frequently as an issue of discussion. Certainly during my service at the Office of Policy Development, I felt that foresight was a function, in fact, perhaps the most important function, of that office. We were the integrative arm for the views of various agencies, both on the issues of the immediate day and issues coming down the pike. Many of the issues that have been mentioned here today are items that I or my colleagues dealt with and tried to be knowledgeable about. Obviously, no one's efforts in a political area meet with unanimous acclaim, but I can assure you it was not simply for failure to think about the issues.

Similarly, at the Energy Department, as the custodian of the great national scientific laboratories such as Los Alamos, Brookhaven, and Argonne, to name a few, many of the issues are being dealt with and considered from a scientific point of view.

For example, Senator Stafford's question with regard to the CO_2 question, the Department of Energy is the lead agency. We are spending something on the order of, I believe, $12 million a year, perhaps $100 million altogether, on the scientific understanding of all of the ramifications of that issue.

The term "global forecasting" is a relatively new one that I would take to refer to the books and studies beginning about 1970 which purported to use mathematical models to produce very broad forecasts and policy conclusions, usually about the interlinked topics of population, resources, and environment.

Attempts to prognosticate about these general subjects were not new. What seemed to be new was the effort to specify these relevant factors within a supposedly objective framework of a mathematical model and the mystique of using a computer. A book by one of the leading global modelers which I discuss in my testimony, suggestively named "Groping in the Dark," gives their analysis of what common conclusions these might have come to, and I would direct your attention particularly to the notion that this type of modeling seems always to lead to the conclusion that "business as usual," which generally means freer markets and less individual control, always turns out to be the less successful policy.

I would point out that another important aspect of usable forecasting should be some specificity. A specific model of, let us say, per capita income or grain production, can be monitored closely and compared to reality. A statement such as "more crowded" or "less stable" is much harder to confirm or deny. In the real world testing eventually comes, though it may be delayed.

Consider a recent account of the results of a 1968 book by Prof. Charles Park, "Affluence in Jeopardy," in which he made a fairly standard projection, perhaps, of coming shortages of nonfuel minerals. His book became required reading for Pennzoil's board of directors who then bought a copper mine, but the mineral shortage did not come. In fact, over the past 16 years the average real price of copper has been below the 1968 level, and is now one-half that level, and certainly the division did not do as well as the directors had projected.

The New York Times reports that Park is philosophical about the turn of events. He says, "Well, in some ways it has been a disappointment." One assumes that the philosophical professor did not own Pennzoil stock, and Pennzoil's directors may have been somewhat less philosophical.

Indeed, one of the remarkable things about global forecasters is how little their reputation seems to have been affected by their past statements.

For example, one representative prediction offered in "Global 2000" was of rising food prices and a sharply reduced rate of increase in world food production. It projected production per capita increasing less than 15 percent by the end of the century, and real prices doubling. Since 1970, however, world grain production per capita has already increased 15 percent, and the real prices for most foods have actually fallen.

I discuss several categories of repetitive errors in forecasting, and I would like to mention just one or two.

A very prime one is what I call peak-to-trough calculations. That is, most important data series have cycles and inherent variability. A determined analyst can pick a peak and link it with a subsequent trough and make a gloomy case, but when we hear the same claim made in 1948 and 1965 and 1973 and 1980, we should be a bit skeptical and perhaps examine the full data sets.

The historian, Macaulay, I think, got it about right 150 years ago when he said, and I quote:

> We cannot absolutely prove that those are in error who tell us that society has reached a turning point and that we have seen our best days, but so said all who came before us, and with just as much apparent reason. On what principle is it that when we see nothing but improvement behind it, we are expected to see nothing but deterioration before us?

Another key error is in looking only at the supposed benefits of believing forecasts and not at the costs as well—what the statistician would call a type 1 as opposed to a type 2 error. In the story of the boy who cried wolf, the fable concentrates on the danger that a true menace, the wolf, will not be recognized, but it is also true that if the farmers spend all of their time helping the boy search for imaginary wolves, the community may starve. Most forecasts do not consider the costs of the particular solution for averting the crisis they predict. Certainly, most of the solutions that we attempted to adopt in the 1970's to the energy crisis could fall into that category.

A broad paraphrase of the findings of most global forecasts is that unless major coercive Government steps are taken to control various sorts of growth—population, resource consumption, or economic well-being—then the following are likely to occur: bad health symbolized by a decline in life expectancy or an increase in infant mortality; poor economic performance symbolized by a decline in per capita income; poor agricultural performance symbolized by a decline in per capita food production or a sharp rise in real prices; and a poor situation in minerals and fuels symbolized by increasing real prices. These are the stock results of this point of view and have been made repeatedly and vigorously in the past. They have also been repeatedly and on a global scale almost universally proved to be false.

I would suggest that most current global forecasts tend to ignore or at least to underestimate the effects human and technological progress will have on the future. In a free economic system, progress rests on the ability of the citizens to respond with innovations to pressures and changes. It is true, as has been contended, that in the production of any resource, the deposits that are easiest and cheapest to find using a given technology tend to be exploited first in a free market, and similarly when implementing conservation techniques as in the case of energy, those which are the easiest and cheapest to implement also happen first.

However, it is frequently overlooked that the entire history of mankind has been a movement to different and better curves of resource extraction and conservation. Despite the lucid accounts in the 1800's of why England was doomed due to the exhaustion of her coal resources, other deposits and other types of energy were developed. Fifty years ago the notion that uranium, an element then useful primarily for coloring glass, could produce enormous energy would have seemed ludicrous, as would the idea that direct conversion of sunlight to electricity could be practical.

A paucity of understanding of progress is perhaps even more deeply engrained on the consumption side. Forecasters sometimes think of substituting one mineral for another, such as aluminum for copper, but no one ever thought that the true substitute for copper in telecommunications would turn out to be sand and rocket fuel in the form of fiber optics and relay satellites. It is this inability or failure to conceive of the possible range of innovation and adaptability of both mankind's wants and the means to satisfy them, that lies at the root of the failures of most predictions of inevitable decline.

Turning specifically to the energy area, certainly if there had been a forecast in 1980 that within 4 years U.S. oil production would reach a 10-year high, that a citizen's ability to buy gasoline in terms of his income would increase 50 percent, or that our energy efficiency in terms of output per unit of energy would increase 13 percent without mandatory government regulations, the forecaster might have been thought quite mad. Yet, each of these has come to pass, and with good policy from the administration and the Congress, we believe that this can continue.

You ask specifically about global energy principles. Our energy principles are set out every 2 years as required by Congress in our national energy policy plan last submitted in October 1983. The next such plan will be issued later this year through the President and the Secretary of Energy. Certainly, our principles of relying on free markets, of building up strategic petroleum reserves, have had good acceptance within the International Energy Agency. In fact, for many years they were urging us to be more free market. They have agreed with our desires that in the event of emergencies there be an oil sharing system that would be at market prices, and we have also secured agreement on coordinated policies for drawdown of stocks in cases of emergency.

Renewable energy and conservation certainly have a significant part to play in our energy system, and they are addressed in my testimony.

You asked specifically about several chapters in the book, "State of the World." These are covered at some length in the testimony, but I would point out primarily that I found these two chapters compared to similar statements in the past to be moving encouragingly in the direction of noting that these resources need to compete on their own merits and to be allowed to compete on their own merits. I certainly think there are places where the chapters may overemphasize a regulatory aspect, and there may be some areas where they are overly enthusiastic, as any promoter is, but I think they certainly represent an improvement from past efforts.

With regard to our coordination of energy data with private activities, I would note that I spent a good part of 2 days recently at a meeting of a committee that we have from the American Statistical Association which advises us on private sector needs and uses of our data, how we can better make use of private data, and what types of data are best needed for the two to work together.

In view of the many pitfalls awaiting would-be forecasters, I am generally skeptical of most efforts to divine the future. This skepticism turns to a deep concern when particular forecasts are used to justify government in making decisions better left to the citizens. Forecasting as a private activity is one thing. You know the kinds of financial books or newsletters you get: "How You Can Profit From The Coming Plague of Locusts." That is one thing. But attempts to make public policy based on the cries of "The goblins will get you if you don't watch out," is quite another. If individuals in 1980 had believed Global 2000 and other recent projections, they would undoubtedly have invested their money heavily in oil wells and in crop land and they would, of course, have lost their assets. But if government requires us all to follow the prescriptions of its forecasts, then we may all lose our assets.

Perhaps the biggest problem with government global forecasting is that it seems to tend toward an authoritarian and centralized view of the economy and of life in general. I have been struck in reviewing global forecasts by how often the rhetoric that clothes the computer runs is of the dangers of uncontrolled something, not the amount or not the result itself, but that someone is not in control. The "limits to growth" philosophy seems to speak often more to the "Joy of Limiting" than to the true problems of growth.

I think the administration's views can be summarized in a speech that Secretary of State Shultz made recently to the National Academy of Sciences. He said, and I quote:

> The technological revolution is pushing back all frontiers on Earth, in the oceans, and in space. While we cannot expect these advances to solve all the world's problems, neither can we any longer speak in Malthusian terms of inevitable shortages of food, energy, forests, or clean air and water.

As President Reagan said in his latest State of the Union Address:

> There are no constraints on the human mind, no walls around the human spirit, no barriers to our progress, except those we ourselves erect.

Thank you. I would be happy to answer any questions.

Senator **MATHIAS**. Well, you announce that you are a skeptic, and that is not an unhealthy thing. I think a dose of skepticism is important to life. It piques our curiosity. It makes us ask the kinds of questions that prove to be useful.

Isn't there, however, a value to forecasting that you may have underestimated? Mr. Hill mentioned Theodore Roosevelt and his projection on the loss of timberland which proved to be erroneous, but may have been the trigger for conservation efforts and a revolution in management of timber which has produced outstanding examples, such as the Weyerhauser Co., which plants as many trees as it cuts. A more recent example that you mentioned is the projections of energy shortages which might have come true if the world had not considerably altered the nature of its approach to energy problems, and placed a higher premium on efficiency and conservation than it had prior to those projections being made.

Isn't there some value in these projections as an example of what happens if you don't do something differently?

Mr. **BOGGS**. Well, Senator, I would make two points. The first is that, obviously, we all try to make plans for our future, and the whole process of progress is people making those changes.

The tenor of global forecasting, however, has been to indicate in most cases that not only private changes need to be made but that some types of government coercive changes need to be made. The distinction is that if Popular Mechanics tells me what kind of car is going to be best for me in the future, I can read it and believe it or not as I choose. If New Republic or National Review tries to tell me what is going to be best for me, they are usually trying to get the government to impose it.

The two examples that you gave, I think, are rather interesting from this point of view. The timber question has been written on very extensively, and in my testimony I cite a book called "The Resource Depletion Myth: The Railroad Use of Timber," which goes into this question in extreme detail. I think that book's tendency would be to say that President Roosevelt's changes or his predictions had very little to do with the facts of the situation or the economic changes that were occurring. Simply based on the situation, those changes were already being made, and that it is not the government's setting aside of forest lands which was the ultimate result of that commission, that has led to today's Weyerhauser activities.

Senator **Mathias**. But that wasn't the only change that resulted. It was a whole change in public attitude, including in the corporations themselves.

Mr. **Boggs**. Well, that is the point I would quarrel with, that I think the book indicates that they were going on considerably before. Certainly, leadership, or calling attention to a problem that turns out to be correctly defined with a correct solution, is also always good.

On the second point you made with regard to energy shortages, the types of responses, that were being made in the 1970's, which primarily relied upon Government controls, both upon supply and consumption, which relied upon an attempt of the Government to analyze and direct how much synthetic fuels we were going to produce, I think we would now look back and see that those were not the right solutions. The changes that have come about have not been because somebody read "Global 2000" or Carter's national energy plan and was forced to follow those directives, but by the choices that were made because they had the freedom to make those changes.

Senator **Mathias**. Just in passing, I might note that one of the barren areas of the world are the Atlas Mountains where they didn't have a Theodore Roosevelt, and there was no cry raised that the Atlas Mountains, which once were heavily forested, would be completely stripped and denuded of their native timbers, and so stripped that they remain bare today except for the most recent efforts at reforestation that have been undertaken. Lacking that voice, the people there didn't take the corrective action which a voice raised here may—may not—have induced the public to undertake.

On page 5 of your statement, you say:

> My skepticism turns to deep concern when a particular forecast is used to justify government making a decision better left to the discretion of free and rational citizens.

Does the market always send correct signals to the citizens? For example, when consumers are billed for electricity, they pay an average price which is lower than the marginal cost to the society that is serving them. If the price were higher, the citizen might pay more for more efficient appliances, might pay more for those things which would conserve electricity, but because the utilities are monopolies and have to be regulated, the price is regulated, and thus the citizen receives minimal signals about the true value of energy so that we may all suffer some loss of efficiency as a result, and ultimately everyone's rate goes up because the individual doesn't get the correct signal about the real value of energy.

Mr. BOGGS. Well, it is certainly the case that Government regulation in many areas can send false signals, and we saw some of that in the middle 1970's when price controls on oil and natural gas tended to cause a greater degree of consumption than would otherwise have occurred.

The electricity area is one that is certainly very contentious as to what the proper means of pricing is, particularly because sometimes the average price is less than the marginal price, and sometimes it is more than the marginal price, and we have created a fairly elaborate means of regulation that attempts to deal with it. It is quite clear that this means of regulation is in some difficulty, and there have been a number of policy initiatives suggested for dealing with it.

I can only answer your general question in saying that the market responds very efficiently to the signals that people are allowed to send through it. As conditions change, it may well be that the types of necessary government regulation may also change.

Senator MATHIAS. What about good news? We generally talk about forecasting in terms of bad news, evil tidings. Isn't there a possibility that a foresight capability would also give us good news, and therefore be the foundation for policies which are predicated on that good news?

Mr. BOGGS. Well, it certainly can, and I think that the better view, normally that is correct. But let me try to perhaps be more explicit with regard to these two phrases of forecasting and foresight.

As I say, forecasting goes on all the time. That is what policy analysis is, and my skepticism, I think, is directed primarily toward a particular kind of forecasting that has come through a particular mindset. I have no difficulty, as I indicate, with either private forecasting or Government forecasting when it is, let us say, understood for what it is. I think the Agriculture witness will talk about how they do forecasting on a short-term basis, and the further out you get, of course, the more difficult it gets.

I do think that Government forecasting, when given—perhaps because of the Government, perhaps because of the private sector—unwarranted emphasis as the one truth leads to what we have seen in areas like timber and energy and farming, when people relying on Government forecasts took actions that turned out later to be very economically unwise as the shortages did not come to pass.

Foresight, as it has been used here, as I think I indicated, is also what Government policymakers do. This is what we did at the Office of Policy Development. We tried to say, in our different areas, what we thought different policy outcomes would be, and I think in general we were, perhaps, more optimistic than the general run of commentators at that time, and on balance I think things have come out a little closer to what we thought than to what the critics thought at the time. That does not necessarily argue in favor of a centralized foresight group or in favor of a foresight group that is in some way dedicated or set apart.

These reactions to the structural question, are simply personal. I don't think the administration has previously commented on this type of legislation, but I know in the policy office, because we felt integrated with real decisions and responsible for the results of our efforts, I think perhaps we had a better check than an office that would, in effect, be set aside and simply perform almost an oracular function that every once in a while would issue its foresights.

I think all over Government people are doing foresight. They are trying to come up with the best policies every day, and they don't do it strictly on the basis of today's crisis. I know that is a temptation. I know that is the way it seems when things are going wrong, but certainly the people that I have worked with in my own areas and across Government can give you very lucid discussions of the kinds of consideration they have given to the longer run issues.

Senator MATHIAS. Well, I think what you say is true, and I think it is desirable that this kind of thoughtful analysis be made, whether you want to call it foresight or whether you want to call it projection or whether you want to call it simply making a judgment about what you should do. It is going on and has to go on.

Wouldn't it be useful to have some forum in which these judgments could be known, could be made available to a broader audience than just the offices that are immediately involved?

Mr. BOGGS. This is just my somewhat off-the-top reaction because I hadn't known that Senator Gore was going to introduce his bill, or that that would be part of the discussion here. Certainly the policymaking activities are made widely known. That is what our Washington community, our newspapers, our academic discussions, are all about. To the extent that you centralize, separate, provide some type of a, quote, "different forum," I think you tend to establish some authority or power without responsibility.

Certainly, it would be a nice office to be the head of. I would think it would be a lot of fun, but you would not be, in effect, in the milieu of policymaking. In fact, you would not have as good a check and an interaction as you have in policymaking. Again, this is just my reaction, but I think that a body that would primarily issue reports or studies would either come under tremendous fire from those whose reports it might disagree with, or if it were going to influence policymaking, would get drawn into the day-to-day efforts. If it were not, it would tend to end up with its reports being put on a shelf, as was suggested in Senator Gore's testimony.

In fact, I think one of the interesting things about this yearning for foresight is not that these issues were ignored. If you go back again through the litany of Social Security and some of these other issues and you go back to the time, one of the things that I have found most fascinating in working in these areas is how many of these things were fully discussed at the time, but a decision was made that turned out not to be the right one. If you read the Social Security actuary's reports of 10, 20, and 30 years ago, these issues were laid out. They indicated what the possibilities were. Obviously, you can't project in advance what the birth rate is going to be 10 years out, but I think the people knew that if the birth rate fell radically, we might have the kind of worker dearth that is causing the Social Security problem.

So having a separate Office of Foresight wouldn't have necessarily made them come out with a better answer.

Senator **Mathias**. But it could help to understand the answers that are given. Now, let's take a very current example. The Senate is about to vote in the next day or two on a recommendation which your office must have been involved in, and that is the elimination of the petroleum reserve as a budget item. Now, I could assume one of several things. I could assume that we are too broke to buy the oil. Or I could assume that we don't need it, that the energy picture has improved so drastically that we don't need to have a petroleum reserve. Or I could make other assumptions. Wouldn't it be desirable to know exactly what was the basis of that decision?

Mr. **Boggs**. Well, sir, having testified on that myself once a couple of weeks ago, and I think I have another hearing tomorrow, I can assure you that I tried to lay out some answers to that and the Senators' questioning me delved into it. In fact, we presented and were confronted with and discussed a whole host of studies made over the past 10 years as to the appropriate size of a strategic reserve. Everyone agrees that it should not grow without limit. Everyone agrees that it has some relationship to how much our imports are, how vulnerable the world situation is, what the price of energy is, and in fact, we laid out those types of issues. We indicated that, for example, today we have over 100 days' worth of all of our imports which is more than we thought we would have with a much larger reserve because our imports have gotten much smaller. Not to go into the discussion at great length, but simply to indicate that these are exactly the kinds of activities that were done by the Department of Energy that were reviewed by Policy Development and others when I was there several years ago and now. Having yet another office to issue its opinion—either presumably they would agree with us, or they would not, and both of those views are already well represented in the policy debate, would add little. Certainly there has been no failure to address these questions. You may, of course, agree or disagree as to whether our position is right.

Senator **Mathias**. I would place a very high probative value on your judgments in this respect, and would give them great weight, but having said that, I would be under no illusion that they are going to be, like the laws of the Medes and the Persians, graven in stone and immutable.

Mr. **Boggs**. And we have indeed said if the situation changes, if imports began to rise, we are holding the system in readiness to add new supplies.

Senator **Mathias**. Now, wouldn't it be of some value to have someplace where you could chart the changes in these projections, foresights, judgments—call them what you will—so that you could see how the tide is moving?

Mr. **Boggs**. Well, I think that is what our Energy Information Administration does. I have some systems up on my own computer. EIA has provided, in fact, on this issue, reports to two members of the House who asked for them, taking assumptions that were given to them. Also we have in our testimony provided past reviews.

So I entirely agree with you on the right kind of thinking that ought to go on in addressing these issues. The procedural issue, as far as bills such as Senator Gore's would be, is, is there a need for a separate organizational structure to do that? And I have indicated some skepticism about it, not necessarily immutable, but I think we should clearly distinguish the substantive question of what kind of thinking is being done, from the procedural one of "Can we improve it by some organizational change?"

Senator MATHIAS. Well, you mention the Energy Information Agency. I understand that you currently have about 32 models in the agency.

Mr. BOGGS. Sounds about—I don't know the number exactly, but I know they——

Senator MATHIAS. It is down from 60.

Mr. BOGGS. That sounds right. I——

Senator MATHIAS. You have cut it about in half.

Mr. BOGGS. I wouldn't doubt it.

Senator MATHIAS. You think that is a good thing?

Mr. BOGGS. Well, it depends on what they were modeling. My recollection of this discussion, when I had it with some folks internally, was that many of the kinds of things we were modeling either were related to the kinds of regulations, and the kind of activities that we were being required to carry on at an earlier time that we no longer do. Second, I don't necessarily know that a head count of models as opposed to how they work, whether they have been improved, what they actually do, is appropriate. I know certainly in a number of areas our number of publications has gone down, but they have been better integrated and the same data is being presented, so I don't really think the number of models really tells us a lot.

Senator MATHIAS. It is, I think, severely reduced in detail that is available, both short term and in midterm models, is it not?

Mr. BOGGS. Well, I have been reading these forecasts, at least the publications of them, for a number of years, and I have not noticed that. Now, our Energy Information Administrator, Helmut Merklein, might be able to give you better answers, or we might be able to provide more complete answers for the record, but certainly in terms of the kind of data that is at least somewhat useful out of those models, I have not noticed a reduction that made my life as a policymaker any more difficult. I can certainly imagine, and this is only an imagining, that we no longer tell you what the price of oil in Maryland is going to be 20 years from now, but that really wouldn't have been very useful anyway. If you don't really believe what the world price is going to be 20 years from now, detail of that is unlikely to be helpful, either.

Senator MATHIAS. I wouldn't be as disturbed by that particular kind of problem as I would by the fact that your 1985 projections don't break out the individual European countries for analysis, for one example. And, given the fact that we not only have strong economic relationships with European countries, but that we have some energy agreements with European countries which could be important in the event of an unforeseen crisis, I think that may be a more serious loss.

Mr. BOGGS. Well, I could certainly take a look at that. I have had some dealings with our members of the International Energy Agency and what other countries expect of us, and how we deal with them, and I have not heard that that kind of failure to make individual projections for their countries is damaging to either us or them, but I am simply not familiar with the detail of it. I will be happy to take a look at it.

Senator MATHIAS. Well, it is the kind of thing that you don't miss until you need it, but when you need it, then you miss it.

Mr. BOGGS. Well, the question is, under what circumstances are you going to want to drive your policies based on it.

Senator MATHIAS. We could discuss this for a long time. We have other witnesses. But I do want to ask you just one or two more questions.

Mr. BOGGS. That is one of the nature of global issues. The discussion can also be global.

Senator MATHIAS. You talk about the unreliability of Third World data, and I think we would agree that any kind of judgments have to be made on the best possible information. What can the United States and perhaps the other OECD nations do to improve the quality of Third World reporting?

Mr. BOGGS. Well, I can mention a couple of things. These are primarily anecdotal in the sense that they are things that I have come across in my dealing with one issue or another.

The international section at Census conducts a very extensive program of consultation, advice, in many cases direct help, as with the Chinese census, to countries, and I think that a lot of those areas are getting better. It has been my impression that the sets of censuses that were carried out around 1980 in many countries were considerably superior to those carried out earlier.

It is also my impression that through NASA, through something they call the Global Habitability Program, they have been attempting to coordinate and improve our ability to understand the processes in the world by remote sensing, and other types of activities. Certainly, the simple scientific advance that is carried out through activities such as our national laboratories leads us to a better scientific understanding. I think perhaps the gentleman from Agriculture who will speak later can indicate their efforts to improve their data gathering and coordination with all the countries of the world on their agricultural statistics.

Senator MATHIAS. In your prepared statement you say that you are unsettled by the finding of the Global 2000 report that the Government is incapable of providing the President with accurate and consistent forecasts.

But you also note that policy analysis is forecasting. Now, I am not sure that these are consistent.

Mr. BOGGS. I think my statement is that I did not find it "unsettling" as Global 2000 reported, that the Government is incapable of accurate and consistent projections about long-term global resource activities. By that I primarily meant that consistency—trying to wrap all of the manifestations of the world or even of resources, population, environment, and force them into a single, consistent model to present to the President—which was the theme of that discussion, is likely to lead to better outcomes.

I have had experience with consensus statements, when you send up in papers to a higher level decisionmaker something that has been cleared by a number of agencies, and the fact that they have all been able to agree on it doesn't necessarily mean that there were not a lot of inconsistencies that frequently are more revealing than the single, consistent ultimate outcome. So in that part of the testimony I was simply indicating that I do not think that the proper purpose of modeling or of policymaking is to create the one, true model that will give a consistent view of everything. Frankly, on that point, I think my discussions with modellers, certainly over the last couple of years, have found them moving more in that direction, that we are likely to do better with models addressed to individual issues that take different approaches and lay them side by side and compare them.

Certainly, I can recall numerous issues in policy development where Commerce would have one model, Interior would have another model, and the best outcome was not to force them to come up with one conclusion, but to compare them, put them side by side, look at their assumptions, look at their results, look at their underlying equations, and inform your policymaking by that, not come up with the one true number.

Senator MATHIAS. Does this method have a wider application? Should this be the method that we use in the future to make available the different, even conflicting analyses?

Mr. BOGGS. Certainly in the energy area, which I now have had the most direct responsibility for, we have made a very strong effort to have our own models documented fully, to have them be what we call transparent. That is to say, for a user, whether public or private, we try to make apparent to them how the assumptions affect the outcomes, and what assumptions are in effect built into the equations. An important point here is, that frequently modelers will say, "Well, we are going to give you a wide variety of assumptions. We have a high and a low for our input variables." But frequently the equations themselves, in effect, have assumptions built into them, assumptions about elasticities, assumptions about people's ability to respond, assumptions about substitutability, and frequently those are built into the equations, and we try to make those transparent as well. So I think that is certainly a direction in which we should all go. I think at Energy that is what we have tried to do, and I think that our Energy Information Administration has a pretty good record and reputation on that.

Senator MATHIAS. Well, you have said that people continue to hold the Global 2000 report in high regard. Was that influence a sort of a unique phenomenon of the Carter administration, or do you think by following the techniques that you have described, the Reagan administration could issue a global report, too, which would not only be updated in terms of the data base, but which would give a more accurate and thoughtful approach by adopting a slightly different tack?

Mr. BOGGS. Well, certainly, the individual units of the administration, in Energy or Interior or Health and Human Services, make all kinds of reports on their activities. The question of whether trying to concoct an effort that lays it all out in one document is one that has certainly had some consideration within the Global

Issues Working Group. Chairman Hill has indicated the work product that they are now hoping to develop. It is not my impression that this would constitute an omnium gatherum the way that Global 2000 was, but part of that gets back to the question of undue reliance, undue prominence, even to our forecasts or projections, which, of course, I would think would be better than someone else's.

Thus far, at least my own opinion would be that following a tradition, if one item can be called a tradition, or creating a tradition, if doing it twice makes it a tradition, would not necessarily be a good thing. I think the individual units of government, I think the academic world, I think the private sector and the nonprofit sector—as with the State of the World publications—are doing a great deal of this, and at least my personal first impression would be that while such an effort would have some use, I am not sure that would be the proper way to go.

Senator MATHIAS. In all of life there is a kind of economy of scale. If you do things in a large enough way, you get—you provoke discussion, controversy, attention, interest, and that would probably be the case with such a report, whereas if you just trickle them out in individual items, the new reports, which may have greater value, and which would at the very least be updating the data, will pass by largely unnoticed, even by people who have a particular interest in them.

Mr. BOGGS. Well, I think certainly I agree with your statement that it probably would provoke controversy and attention.

Senator MATHIAS. But they would be of value. The authors of the "Global 2000" report itself admit that it has deficiencies and errors. All of that could be bound up in a new edition.

Mr. BOGGS. Well, I am not sure. Certainly the things that we have done in Energy, I don't think that they have escaped the notice of the people who are, indeed, involved and concerned with energy. Certainly you make a case that has some strength. I think the converse, that people concerned in each field are actually more likely to pay attention to something that comes out of an area that they have somewhat more confidence and interaction with, rather than a single compendium, also has some. I imagine even in the 1970's that people paid more attention to what Jim Schlesinger was putting out on energy that they did to "Global 2000."

Senator MATHIAS. Well, repetition has some value. "The Paley Report" could have saved the automobile industry in this country a lot of grief had it been received seriously.

Mr. BOGGS. Part of it is always a question of when to believe in it. The "Paley Report" was issued in 1952. Had many of its things been believed in in 1954, let's say, I imagine they would have lost enormous amounts of money between then and 1973, and whether that would have offset what subsequently happened, that is always a question.

Senator MATHIAS. But if in 1954 there had been a "Paley Report II" which took a second look at it, and periodically thereafter, there might have been a more effective use of that information and a better assessment of the proper time for that information, and a more responsible response to it.

Mr. **Boggs**. Well, that is certainly what we try to do within our own energy area, sir.

Senator **Mathias**. I might ask you the same question I asked of Mr. Hill, if you would be willing to respond to a few additional questions.

Mr. **Boggs**. Certainly I would be very pleased to.

Senator **Mathias**. Well, in order to conserve the time of the other witnesses, I think we had better leave it at that. Without objection, that will be made a part of the record.

[Mr. Boggs' prepared statement and responses to written questions follow:]

STATEMENT OF DANNY J. BOGGS

DEPUTY SECRETARY

U.S. DEPARTMENT OF ENERGY

before the

SUBCOMMITTEE ON GOVERNMENTAL EFFICIENCY AND THE DISTRICT OF COLUMBIA
of the
COMMITTEE ON GOVERNMENTAL AFFAIRS

and the

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

APRIL 30, 1985

Mr. Chairman and Members of the Committee:

Thank you for this opportunity to offer some thoughts concerning the issue of "global forecasting" and the capabilities and proper role of the Federal Government in that area. Today I want to address the following:

- Common threads and themes in public policy forecasting and what has been called global forecasting;
- An analysis of past results and recurring problems with such forecasts;
- Specific energy forecasts and outcomes, and specific questions you have raised; and finally,
- Some thoughts on how governments (and private groups) can or should make use of forecasting.

Over the past several years, I have had experience with the uses of forecasting in the study and formulation of public policy, currently as Deputy Secretary of Energy, and earlier as a Special Assistant to the President for Policy Development and Executive Secretary of the Cabinet Council on Natural Resources and the Environment and the Cabinet Council on Food and Agriculture. I have had to deal with controversies concerning observed data, and projections of the likely future, in many fields.

I. Common Threads and Themes

My general view is that a policymaker should make use of all helpful analytical tools: this may include forecasts and the computer modeling techniques that can be used to develop them.

Forecasting is neither new nor odd. In a practical sense, policy analysis is forecasting. The policymaker assesses the situation and projects a range, wide or narrow, of likely outcomes if present policies continue. Other policies are then explored, with their respective projected problems and outcomes. If the result of one of these alternative courses is judged to be more appealing than the others and the status quo (a determination that should include, in addition to numerical evaluation, the effect on broad principles such as individual freedom or social stability), the policy which is believed to bring this more desirable outcome tends to win out in the councils of government. On the other hand, if none of the alternatives lead to better results than those expected from the continuation of the status quo, the rational policymaker should utter that magic phrase, "If it ain't broke, don't fix it," and move on.

In carrying out his analysis of forecasts, a policymaker should also look at the track record of particular forecasters, or of particular modes of analysis. And later in this testimony I devote some time to that exercise (see pp. 3-4, 12-13). He should also try to discern and examine the paradigms that usually underlie the bare equations of a model, if one is used.

A paradigm that the law of supply and demand usually works, and that free people generally produce better results than those under controls, will lead to equations quite different from those conceived under a paradigm that more economic growth or more population or more use of resources is inevitably harmful. Finally, it may be useful for a forecaster to address specifically the logical structure imbedded in a forecasting model by the use of some checklist such as I offer later (see p. 10).

Turning first to the track record of forecasts, I would note a few outstanding examples:

In 1905, Theodore Roosevelt spoke of the coming deforestation of America:

> If the present rate of forest destruction is allowed to continue, with nothing to offset it, a timber famine in the future is inevitable. [1]

His concerns were echoed by Gifford Pinchot, whom he appointed the first Director of the U.S. Forest Service:

> We have timber for less than thirty years at the present rate of cutting... We have anthracite coal for less than two hundred. Our supplies of iron ore, mineral oil, and natural gas are being rapidly depleted, and many of the great fields are already exhausted. [2]

Under the Hoover Administration, demographers Warren S. Thomson and P.K. Whelpton, writing in the final report of the Commission on Recent Social Trends, projected:

> It seems likely that the growth of [U.S.] population will be small in the future. Continuation of recent trends would mean that the population will be between 132,500,000 and 134,000,000 in 1940, between 140,500,000 and 145,000,000 in 1950 and between 145,000,000 and 170,000,000 in 1980. [3]

Turning briefly to forecasts from outside the Government, A Public Affairs Institute tract of 1950, backed by such worthies as Abe Fortas, Hubert Humphrey and Edmund G. "Pat" Brown, advised:

> Scarcity prices -- due to nothing but shortages -- have moved in on us. They are going to live with us from now on out, unless we act strenuously and purposefully. [4]

And Paul Ehrlich, in The Population Bomb (1968) told us that famines in the 1970's would kill hundreds of millions and that the stork had passed the plough in 1958. He offered numerous scenarios, the most optimistic of which involved the death by starvation of one fifth of the world's population. [5]

I have selected these predictions because they seem to me to be a fairly representative sample of prominent (and attention-getting) forecasts. They were also flatly wrong.

Through the centuries, attempts at foresight have failed because of inferior or incomplete data; mathematical and conceptual errors; and the tendency of advances in computing power to outstrip advances in theory. My purpose in mentioning these hazards is not simply to assail the often well-intentioned forecasting industry. Accurate forecasting is not impossible, but it's tough. A forecaster's job would be made a great deal easier if people behaved according to observable, immutable laws, much as objects obey the laws of physics, but they don't.

In view of the many pitfalls awaiting would-be forecasters, I am generally skeptical of most attempts to divine the future. My skepticism turns to deep concern when a particular forecast is used to justify Government in making a decision better left to the discretion of free, rational citizens. Forecasting as a private activity (perhaps epitomized by the market newsletters you get, with titles like: "How You Can Profit From the Coming Nuclear Holocaust or Plague of Locusts") is one thing; attempts to make public policy based on cries of, "The Gobble'uns 'll git you Ef you don't watch out" is quite another.

Global Forecasting

The term "global forecasting" is a relatively new one, and does not necessarily have an agreed upon meaning. I will try to give a brief description of what I understand to be meant by that term. Starting probably with the book Limits to Growth, [6] published in 1970 as a report to the Club of Rome, there have been a number of books and studies which purported to use mathematical models to produce very broad conclusions, usually about the interlinked topics of population, resources, and environment. In some cases extremely simplified representations were made of these factors, while others attempted to project outcomes for finely divided groups of commodities such as individual food or metal prices, or individual pollutants in specific regions. As the earlier examples showed, attempts to prognosticate about these general subjects were not new. What seemed to be new was the effort to specify relevant factors within a supposedly objective framework of a mathematical model, the mystique of using a computer, and in many cases the alleged size and impenetrability of the model, though in many cases the results in fact rested on a very few equations.

The results of such an effort need not be gloomy, based strictly on the nomenclature or methodology employed. However, as a result primarily of the underlying predilections of those who have engaged in this effort, global forecasting has come to be associated with a particular mindset. This mindset holds that a series of very unpleasant results are likely to occur if some type of external order is not imposed on the individual choices and processes of humans.

I would note that this broad analysis is not simply mine. The book Groping in the Dark, [7] by Donella Meadows, John Richardson and Gerhart Bruckmann reviews seven major global studies and develops a list of a dozen statements on which these global models tend to agree. These twelve observations about the nature of the world tend to fall naturally under three broad categories which, for our purposes today, constitute an excellent paradigm of the global study from the perspective of current leading global forecasters.

First, according to the Meadows et al. summary, global studies generally admit to a great deal of uncertainty. While "continuing current trends is not a likely future course," they argue, the exact nature of the future, "and whether it will be better or worse than the present, is not predetermined ..." This is due to both a shortage of good data ("There is a great deal of information, which optimists read optimistically and pessimists read pessimistically") and good theory ("Actions taken at one time and on one part of the globe have far-reaching consequences that are impossible to predict intuitively, and probably also impossible to predict ... with computer models").

Second, global models tend to subscribe to an ideology of perpetual scarcity: "Population and physical (material) capital cannot grow forever on a finite planet." Thus, continuing "business-as-usual" policies, according to Groping in the Dark:

> will not lead to a desirable future -- or even to meet basic human needs, it will result in an increasing gap between the rich and the poor, problems with resource availability and environmental destruction, and worsening economic conditions for most people.

One ignores these warnings only with great peril for, as the Meadows et al. paradigm advises, "By the time a problem is obvious to everyone, it is often too far advanced to be solved."

Finally, global studies surveyed by Meadows, Richardson and Bruckmann tend to assume that sweeping changes in the world political, economic, and social order can avert calamity. The globalists support public policy reform on a truly global scale:

> ... single, simple measures intended to reach narrowly defined goals are likely to be counterproductive. Decisions should be made within the broadest possible context, across space, time, and areas of knowledge.
>
> Cooperative approaches to achieving individual or national goals often turn out to be more beneficial in the long run to all parties than competitive approaches.

These twelve points are flexible enough to accommodate a variety of philosophical approaches to government. For example, Meadows *et al*. observe that major global studies tend to agree:

> Although technical changes are expected and needed, no set of purely technical changes [is] sufficient in itself to bring about a desirable future. *Restructuring social, economic and political systems* [is] *much more effective* (emphasis added).

That view makes some sense, but would lead to radically different outcomes if the world is restructured toward greater individual freedom, expanded free trade and stable currencies; or toward more socialism, increased protectionism, or irresponsible fiscal and monetary policies.

The general tendency of those labeled as global forecasters has been in the direction of restructuring for greater and broader control. Another of the common principles identified in *Groping in the Dark* is "decisions should be made within the broadest possible context, across space, time, and areas of knowledge." Since it is exactly the tendency of the myriad of private decisions which make up a free society not to be made in this way, a coherent policy across such broad parameters seems to be enforceable only by an extremely intrusive government.

It should be noted that although the techniques of global forecasting may be new, they can be put to ends that are very old. And we have seen too much of the results of those who labeled themselves "the new order" or "the wave of the future" to accept uncritically the idea that we should follow the views of those who claim to be in tune with the future. Thus, themes found in global forecasting which are quite old include:

° If you don't listen to me, things will keep getting worse.

° Things can be improved by:

  - stopping the growth of cities (a common theme since Oliver Goldsmith [8]);
  - stopping or reducing the accumulation of wealth; or
  - restraining the tendency of lower classes to acquire amenities once available only to "their betters."

° Things can be improved by putting direction in the hands of a strong leader (Captain of "our little spaceship").

Forecasting Problems

There are many problems which must be overcome in successful forecasting, the first of which is to specify precisely what it is you are trying to forecast. The analyst (or businessman, or philosopher) who cannot specify what he is forecasting is likely to be distracted by irrelevant data or models, and may generate only an emotional miasma, not a testable hypothesis.

Assuming that a forecaster can specify his target, he next faces the task of constructing a system to produce his forecast. Relevant questions may include:

1. What factors influence the outcome?

2. In which direction do they influence it (do we even know the sign of the coefficient)?

3. What is the magnitude of the coefficients?

4. How well can you measure each of the factors that you believe influence the outcome?

5. Does a given factor vary over time? Does it vary depending on the absence, presence or magnitude of still other factors?

6. How dependent are you on your prediction of these factors?

7. How much of this variation is essentially uncontrollable and how important is it? (Thus, in predicting electric utility demand for a specific day in December of this year, the weather forecast is extremely important, and even overwhelming within the relevant ranges. For predicting demand over the five year period 1990-1995, it is almost negligible as a factor.)

In the process of answering these questions, the forecaster constructs his research plan and develops his methodology, which could include one or more forecasting models.

The difficulty in making accurate forecasts varies directly with (1) the length of time over which conditions are to be forecast and (2) the number of variables which need to be considered and related to each other. Thus, it is easier (though perhaps less interesting) to forecast "kilowatt-hour sales by

Company X in 1985" than it is to predict "Culture, Cuisine and General Happiness in the 21st Century." On the other hand, the risks associated with making wrong forecasts (professional embarrassment, financial ruin for the forecaster or his employer) varies inversely with the time and range of issues studied; there is more risk to the Chrysler economist whose projections of the size of the auto market for next year turn out to be seriously in error, than to the university or government forecaster who overshoots world population in the year 2000 by a billion or so (as the 1970 CEQ annual report appears to be doing). [9]

For example, Charles F. Park, Jr., in his 1968 book *Affluence in Jeopardy*, [10] predicted a coming shortage of non-fuel minerals. In his introduction, Park wrote: "The author offers this book with urgency, with trepidation and with conviction." According to an article which appeared in the *New York Times* three years ago, Park's book became required reading for Pennzoil Company's board of directors, who were so taken with the author's urgency, trepidation, and conviction that they bought a copper mine. But the mineral shortage never came, and Pennzoil's minerals division did not do as well as the directors had projected. "We hoped that when one mineral was doing badly another would do well," Pennzoil Chairman J. Hugh Liedtke said in 1982, "and that has been true up until now." Over the past 16 years, the average real price of copper has been below the 1968 price, and is now barely one-half the 1968 level. Mr. Park is philosophical about the turn of events. "Well, in some ways it has been a disappointment," he said of developments. "I am perfectly willing to admit that I did not foresee a depression in prices at that time." [11] One assumes that the philosophical Professor Park did not own any Pennzoil stock. And one assumes that Mr. Liedtke may have been somewhat less philosophical.

Global forecasters, then, enjoy a mixed blessing. On the one hand, their job -- predicting the net effect of changes in a vast array of variables over a great length of time -- is very difficult; on the other hand, errors in their predictions are generally discovered so much later as to carry with them little appreciable risk to the forecaster.

Indeed, one of the remarkable things about global forecasters is how little their reputation seems to be affected by an examination of their past statements. For example, one representative prediction offered in *The Global 2000 Report to the President: Entering the Twenty-First Century*, was of rising food prices and sharply reduced rate of increase in world food production. *Global 2000* projected that world food production per capita would increase less than 15 percent from 1970 to 2000. Over the same period, *Global 2000* predicted real food prices would double. [12] Since 1970, however, world grain production per capita has already increased about 15 percent; current world grain production per capita is the highest in history. Adjusted for inflation, the average world wheat price has fallen about 10 to 15 percent since 1970; average world corn prices have dropped about 25 to 30 percent over the same period. [13] It appears highly unlikely that the report's food predictions will approximate reality by the year 2000. Yet numerous observers continue to believe that the *Global 2000* report's projections are highly significant.

II. Past Results and Repetitive Errors

It is instructive to review a few broad categories of repetitive errors in order to identify those which can be more easily avoided (thereby improving the odds that a given forecast can be usefully analyzed) and those which seem to stem from institutional or ideological bias (and are therefore likely to be much harder to root out).

First, forecasters make what I would describe as some fairly simple "data errors" -- basing their conclusions on inferior or incomplete data, or committing mathematical errors which do violence to good data.

As my colleague Al Hill, Chairman of the Council on Environmental Quality, testified in 1982 before a Senate Foreign Relations Committee hearing on global trends, models are, at best, only as good as the information and equations on which they are based. A special problem arises when one begins to track international statistics; while much of the data collected in the United States and other industrialized nations is generally reliable, the Third World varies widely in the reliability of their reported data. For example, the question of global deforestation has come to be seen increasingly as one of particular areas, not of a significant reduction in worldwide forest coverage. The question for modelers then becomes one of whether to utilize inaccurate data, misleading data, or no data. In addition, a small error in data, when projected over 20 or 30 years, can become a gross error of such magnitude as to destroy the reliability of the predictions. [14]

A second common mistake forecasters make is illustrated in the writings of Mark Twain:

> In the space of one hundred and seventy-six years the Lower Mississippi has shortened itself two hundred and forty-two miles. That is an average of a trifle over a mile and a third per year. Therefore, any calm person, who is not blind or idiotic, can see that in the old Oolithic Silurian Period, just a million years ago next November, the Lower Mississippi River was upward of one million three hundred thousand miles long.... By the same token any person can see that seven hundred and forty-two years from now the Lower Mississippi will be only a mile and three-quarters long. [15]

Twain continues: "There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact." Mathematics cannot by itself tell us anything about the future course of a trend line, because any number of perfectly described mathematical curves may be fitted to the same points, given enough equations. Much of the difficulty with trend projection is that a given curve which seems to be plotting along very nicely could be a portion of an exponential curve, a logistic curve, or a sine wave. For some portion of their length, all three will appear very nearly the same.

This mathematical difficulty is further complicated by the fact that pure trend analysis is at odds with the actual behavior of people and populations. Rene Dubos, the renowned ecologist, wrote in a 1981 Wall Street Journal essay:

> ... the creators of global scenarios should always keep in mind that the cautionary statement "if trends remain the same" is completely useless because, wherever human beings are concerned, trend is never destiny. [16]

Third, many apparently alarming trends may be only a matter of looking at selected years rather than a full set of data. The nature of trend analysis is that a case can frequently be made by looking at a specific period of time that something is not growing, or is not doing as well as before. We can see this phenomenon at work with United States life expectancy and infant mortality figures. In the burst of postwar enthusiasm, the continually rising life expectancy was seen as a sign of rapid social and economic progress. When this indicator showed very little improvement, as it did from 1955 to 1969, many observers were convinced that their favorite evil (poverty, pollution, government control, etc.) was showing its effects. However, life expectancy resumed vigorous growth after 1969, making it more likely that the alleged doom-causing factor had never been at work, rather than it had suddenly ceased to operate. [17] Similarly, the infant mortality rate decreased almost 40 percent from 1940 to 1950, but fell only about 11 percent from 1950 to 1960.

The National Center for Health Statistics opened its 1965 review of infant and perinatal mortality by observing: "The relatively poor progress in reducing infant mortality since the early 1950s has been a source of increasing concern in the United States." From 1970 to 1980, however, the decline in infant mortality resumed its earlier pace, falling 37 percent, and has fallen another 14 percent since 1980. [18]

Another very common failing is to take every fluctuation in an inherently cyclical activity as a sign of impending decline. As noted earlier, any reasonable view of long-run world grain production per capita shows an increasing trend. However, by using 1973 (a year of extremely good weather and yield) as a "turning point," writers have tried to show that growth from 1973 to 1982 was much lower than a trend line drawn through the peak year of 1973. This type of "peak-to-trough" analysis is quite shallow. If one changes the "crucial year" to 1974, the result shows improvement continuing strongly.

Biases in Forecasting

Of course, a model could be technically correct and still lead to erroneous conclusions. Such outcomes are the result of a second set of errors which stem from misplaced emphasis, institutional behavior or ideological bias. As errors go, they are more difficult to identify than an incorrect coefficient or an improperly plotted line. But these errors in assumptions can dramatically skew forecasts and must be taken into account by the policymaker or other consumer of forecasts and models.

First, forecasts emphasize specific problems or areas of concern and ignore others, often leading to what statisticians normally refer to as a "Type I" or "false positive" error. In the story of the boy who cried wolf, the fable concentrates on the danger that a true menace -- the wolf -- will not be recognized. But it is also true that if the farmers spend all of their time helping the boy search for imaginary wolves, the community may starve. Thus, there may be "crises," if foreseen and averted, whose "solutions" may be far more costly than if steps had not been taken to "avoid" the "crisis." Swine flu is an example of a Type I error; the costs of universal vaccinations against swine flu, in money and in diseases caused by the vaccine, probably outweighed the costs had the flu simply run its course. Much of our past energy policy involved measures alleged to respond to inevitable supply shortages and price increases which often exacerbated them.

Second, biases may also creep into models or projections as a result of self-interest on the part of the forecasting party. The real motive of many forecasts, especially those which point to alarming trends and coming disasters, is to use fear to enhance the power of a minority of analysts. In The Depletion Myth: A History of Railroad Use of Timber, Sherry Olson analyzes the era of feared timber famine and quotes one of the Nation's chief foresters of the time as advising foresters that in their daily inventory of forest lands, the exercise of a little self-interest wouldn't hurt:

> It behooves, then, every forester, to find justification for his art and for his own existence in the answer to the inquiry which will bring out the fact that natural supplies are waning, and are not being replaced as fast as consumed. [19]

Third, due to ideological bias or naked self-interest, global forecasters tend to produce gloomy results.

Examples abound. Paul Ehrlich, in The Population Bomb, recommended a checklist of truths about the state of the world which his readers should include in letters to their Congressmen and Senators, such as: "The world is running short of vital resources, and the American economic system must adjust to this reality." [20] In a sequel publication, The End of Affluence, Ehrlich warned that "the game of unlimited growth is ending, like it or not." [21] Lester Brown, renowned seer and president of the Worldwatch Institute, was reported in a recent New York Times article to measure his progress by the headlines that result from his work, including: "Fertile Land Areas Found Dwindling"; "Study Cites Peril in World Agricultural Decline"; and "Land Reform Efforts Said to Falter." [22] In a recent interview, Brown stated "there is nothing to arrest the decline" in food production on the African continent:

> In Africa as a whole, per capita grain production peaked around 1967 and has been sliding downhill ever since. There is every reason to believe that the slide will continue ... The arithmetic at this point is pretty grim. [23]

Yet the same was said of Asia in the 1960s, and agricultural production there has increased remarkably with more freedom for the farmers.

The opening salvo of *Global 2000* provides an outstanding example of doom-and-gloom forecasting writ large:

> If present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources, and environment are clearly visible ahead. Despite greater material output, the world's people will be poorer in many ways than they are today.
>
> For hundreds of millions of the desperately poor, the outlook for food and other necessities of life will be no better. For many it will be worse. [24]

Some would argue that these disturbing conclusions were arrived at only after careful analysis of trends and the current situation. I disagree. Disputes over evidence and analysis of conditions are often only excuses for trying to justify predetermined conclusions that everything is destined to get worse. *Global 2000*, for example, suggested that as modeling and computing capabilities improved, the projections would *automatically* be more alarming: "More consistent, better integrated projections would produce a still more emphatic picture of intensifying stresses, as the world enters the twenty-first century." [25] The dominance of this view in public perception of global forecasting is illustrated by a recent *New York Times* story about a conference on global issues. In describing the participants, the reporter said that there seemed to be a few experts there, but that the audience appeared to be comprised mostly of optimists. [26]

Finally, global studies tend to ignore or at least to grossly underestimate a particular force that shapes the future. Progress rests on the ability of people in a free economic system to respond to pressures and changes with innovations. This means the ability of both supply and demand to respond to changing conditions. This ability is frequently disparaged by reference to a fairly simple-minded view of the law of diminishing returns. It is true that in the production of any resource [illegible] deposits that are the easiest and cheapest to find, using a given technology, tend to be exploited first in a free market. Similarly, when implementing conservation techniques, as in the case of energy, those which are the easiest and cheapest to implement happen first. However, it is frequently overlooked that the whole history of mankind has been a movement to different and better curves of resource extraction and conservation. Getting energy from oak trees indeed became more expensive over the years in England, which is why coal became the fuel of choice. Despite Jevons's lucid account of why England was doomed due to the exhaustion of its coal resources, other deposits and other types of energy were developed. [27] Fifty years ago, the notion that an element useful primarily for coloring glass, uranium, could produce enormous energy would have seemed ludicrous, as would the idea that materials and techniques could be developed that might make direct conversion of sunlight to electricity practical.

This fallacy is perhaps even more deeply ingrained on the consumption side. Thought is sometimes given to the substitution of one mineral for another, as for example aluminum for copper in wiring. But it turned out that the true substitute for copper in telecommunication was sand and rocket fuel in the forms of fiber optics and relay satellites. These have combined to make it likely that one of our most important copper mines in coming days will be the now discarded wiring, whose impending shortage was at times trumpeted as a sign of collapsing civilization. It is this inability, or failure, to conceive of the possible range of the innovation and adaptability of both mankind's wants and the means to satisfy them that lies at the root of the failure of most predictions of "inevitable" decline.

A paucity of faith in human and technological progress is not an inherent flaaw in global forecasting; when modeling (or guessing about) the future, one could insert sufficiently great elasticities to cover the possibility of many technological advances. It is true, for example, that Global 2000 says that it assumes continued advances in technology; but other than as an exhortation, there is no indication in the report as to what this really means. As I mentioned earlier, Groping in the Dark observes from their studies of major global models that "although technical changes are expected and needed, no set of purely technical changes [is] sufficient in itself to bring about a desirable future." [28]

Reagan Policies Cheat Forecasters

Through the centuries, various combinations of the foregoing categories of errors have bedeviled attempts to predict the future. But the history of bad forecasts attempting to influence policy is not simply an ancient one. During the course of the Reagan Administration, there have been repeated attempts in a great number of fields to change or disparage the President's policies based on erroneous statements of their likely outcome. In case after case, history has put the lie to them.

For example, in early 1981, the conventional wisdom was that inflation, then raging at about 10 to 14 percent, was here to stay. An economist from Data Resources, Inc. (DRI) testified in Congress that "one cannot escape the conclusion that the net effect of the President's program is to make the inflation rate worse." The chief economist of the New York Stock Exchange admitted the possibility that inflation could be pared in half, but "not before 1985 at the earliest." [29] The consensus among forecasting firms of estimable reputation -- including DRI, Wharton, Chase and Citibank -- was that inflation would decline to between 8 and 9 percent in 1982 and drop slowly thereafter. [30] In fact, inflation, as measured by the GNP deflator, fell from 9.6 percent in 1981 to 6 percent in 1982 and about 4 percent in 1983, about where it has stayed ever since.

Henry Kaufman, chief economist of Salomon Brothers Inc., said in October 1981 that "we must regard it as an achievement if our economy continues to sputter and spurt, lurching from recession to recovery, but with no sustained period of economic growth or lower inflation and interest rates" (emphasis added). "To expect more," said Kaufman, "would be downright unrealistic." [31] Adjusted for inflation, the Gross National Product (GNP) grew 11 percent from 1980 to 1984. Real GNP has increased every quarter since the third quarter of 1982. This is the strongest economic recovery in 33 years.

Despite doom-and-gloom forecasts that Reagan Administration policies would increase crime, undermine public health and workplace safety, diminish educational achievement and injure the national psyche:

- Total reported crime dropped 13 percent from 1980 to 1984. At most, only about 2 percent of this total decrease in crime can be explained by the effects of demographic changes, as the number and percentage of Americans in the high-crime age group (15 to 24) decreases. [32]
- The broad health numbers are equally encouraging. From 1980 to 1983, average life expectancy at birth increased at an annual rate of 0.45 percent (well above the trend of the past 20 years) and now stands at 74.7 years -- the highest in history. Since 1980, infant mortality rates fallen about 14 percent. Over 30,000 babies are alive today who would not be, had the infant mortality rates of 1977-80 been maintained. [33]
- Total coal fatalities per ton of coal produced fell about 14 percent from 1980 to 1984. In each of the years 1982 to 1984, coal fatalities per ton of coal mined were lower than in any previous year. [34]

- Since 1981, national average Scholastic Aptitude Test (SAT) scores have risen 7 points, reversing nearly two decades of unbroken decline. Average SAT scores rose in two of the past three years, the first time this has happened since the early 1960s. [35]

- The "Gross National Spirit Index," a figure that aggregates answers to six major survey questions about personal satisfaction and optimism, is at its highest ever. According to Public Opinion magazine, this indicator of "the national mood" has risen 27 percent since March 1982. [36]

The fact that models cannot include attitude or morale is another impediment to accurate forecasting. Nations and individuals anxious about the future will make different consumption and production decisions than those optimistic about a future situation.

III. Energy Forecasts

If, in 1980, we had heard explicit forecasts that in four years the United States oil production would hit a 10-year high, that Americans' ability to buy gasoline in terms of their incomes would increase by 50 percent, or that energy consumption per unit of economic output would decrease 13 percent, the forecast would have not been believed -- and the forecaster would have been considered quite mad. The actual forecasts were uniformly pessimistic -- and uniformly wrong, for those facts have come to pass. While I believe we have a long way to go, the energy progress we have made since 1981 is real and substantial.

Crude Oil Prices. In the first few weeks of his first term, President Reagan moved the country in a new direction by ordering the immediate decontrol of domestic petroleum and the removal, where possible, of restrictions on energy use. Energy experts wedded to the *status quo ante* Reagan sounded the alarm. One Congressman, now chairman of an important energy subcommittee, warned that oil decontrol "as a cure will prove worse than the disease" and described Saudi oil minister Yamani's prediction at that time of imminent $50-a-barrel oil as "optimistic." [37] In 1981, a Conoco vice president said that oil prices "are not likely to weaken from present levels" and a Sohio executive observed, "an important point is that nobody is predicting a downturn in oil prices." [38]

What happened? Oil prices peaked March 1981, two months after decontrol, then began a long, nearly continuous decline. Since this Administration took office, the price of imported oil to U.S. refineries has fallen about $11 per barrel -- about 40 percent in real terms.

Gasoline Prices. In January 1981, a Sunoco spokesman said that "undoubtedly there will be more increases" in gasoline prices "now that we've had decontrol." [39] The July 1981 Short-Term Energy Outlook by the Energy Information Administration (EIA), the policy-independent statistical arm of the Department of Energy, projected $1.47 per gallon gasoline by June 1982. [40] From 1981 to 1984, the average price of a gallon of regular gasoline dropped

14 percent; adjusted for inflation, that gallon of gasoline now costs about the same as it did in 1956.

Domestic Oil Production In 1979 and 1980, a number of venerable institutions -- including EIA, Congressional Budget Office, the General Accounting Office and the Office of Technology Assessment -- projected that 1985 domestic oil and gas liquid production would be significantly below the 1979 level of 10.2 million barrels per day. [41] Their estimates for 1985 ranged from a low of 7.2 million barrels per day to a high of 9.4 million barrels per day. In fact, domestic production has increased about 280,000 barrels per day since 1979 and now is at about 10.5 million barrels per day. As a group, these projections underestimated 1985 production by 1 million to 3 million barrels per day. Domestic oil production has in fact risen steadily over the past four years; in 1984, we produced more oil than in any year in the past decade.

Oil Imports. Although estimates vary widely," the first National Energy Plan warned in 1977, "the most reasonable range of estimates of 1985 world oil imports is 12 to 16 million barrels per day." [42] The Congressional Budget Office (CBO) projected in 1980 that U.S. oil imports would rise to 10.1 million barrels per day by 1985, or about 52 percent of total product supplied. [43] On a stock-adjusted basis, average net imports for the 12 months ending February 1985 were about 4.4 million barrels per day -- less than half the levels projected by CBO. Moreover, average net imports for the 12 months ending February 1985 account for about 28 percent of total domestic product supplied. [44]

Heating Oil. To take a more recent example, news reports last Autumn were filled with predictions that Winter would bring heating oil price hikes and supply disruptions. Ed Rothschild, of the Citizen/Labor Energy Coalition, warned that "consumers of heating oil are in for another ambush." [45] Joan Claybrook, president of Public Citizen and co-founder (with Ralph Nader) of a Washington-based consumer fuel project, predicted that Northeasterners would "be waiting in the cold for oil deliveries ...and when they purchase their oil, they'll be forced to pay through the nose for it." She said that home heating oil would cost $1.40 a gallon by the end of Winter. [46]

Winter is over, and we can confidently say that the expected horrors of a heating oil crisis did not come to pass. The average national retail price of a gallon of home heating oil was about 5 cents per gallon cheaper this Winter than last. Adjusted for inflation, the price per gallon fell about 8 percent from the previous Winter. In fact, real prices of heating oil have fallen between 6 and 8 percent each Winter since 1981-1982, for a total drop of more than 20 percent. That includes the 1983-1984 season: Notwithstanding a sharp 25 percent rise in the wholesale price of heating oil in January 1984, from 81 cents to $1.01 per gallon, the season's average retail price dropped from $1.15 per gallon in 1982-83 to $1.10 per gallon in 1983-84. [47]

The projections contained in the Global 2000 report have fared just as poorly. For example, Global 2000 projected "no early relief from the world's energy problems," based in part on the assumption that real world oil prices would increase at an annual rate of 5 percent between 1980 and 1990. [48] Since 1980, the real world oil price has fallen well over 5 percent per year. Had the Global 2000 assumptions become reality, the world oil price would be about double what it is today.

There are signs that global energy forecasters may be learning from some of their past mistakes. Two chapters in State of the World 1985, [49] "Increasing Energy Efficiency," by William U. Chandler, and "Harnessing Renewable Energy," by Christopher Flavin and Cynthia Pollock, suggest a growing acceptance of the importance of market forces in determining the world's energy situation. Chandler writes that "market prices and the removal of energy consumptions subsidies are prerequisites for an energy-efficient economy." [50] Flavin and Pollock conclude their chapter with a recommendation that is somewhat consistent with current Administration policy:

> Perhaps the best thing that government planners could do would be to stop trying to pick the most promising new energy technologies in advance and instead create a level playing field on which renewable and conventional resources can compete economically. [51]

These two chapters extol the virtues of energy conservation and renewables, resources which have a strong role to play in the U.S. energy economy. In terms of total renewable energy production in the United States today, hydroelectric power and wood consumption predominate. Hydroelectric power production in 1983 and 1984 exceeded all previous years, due to a combination of good weather conditions and a modest increase in capacity. Until 1984, the contribution from hydroelectric power exceeded that from nuclear power. Wood energy use has increased markedly in recent years, though still remaining below the level of hydroelectric power. Other sources, such as geothermal, wind, and solar, are showing large rates of increase, but have not yet reached an absolute level to be a significant factor on a national scale, although they are becoming increasingly important in localized areas. [52] We expect this trend to continue, and are continuing to support a substantial level of basic research and development aimed at providing the scientific background and concepts for future commercial development by the private sector.

The extent to which the authors believe that energy conservation and utilization of renewables should be mandated by the Government is cause for some degree of concern. "Regulatory policies can provide a minimum level of efficiency where markets fail or do not exist," says Chandler. [53] The recommendations and tone of some parts of these chapters illustrate a common failing of a single-minded focus upon one aspect of a situation. Certainly, additional measures can be taken which reduce energy consumption, just as energy production could be increased further by various types of subsidies. However, costs as well as benefits are involved. Citizens may not choose the type of product characteristics or life style changes implied by one or another particular measure advocated by this or other works. Steps which conserve energy may be quite costly in terms of time, inconvenience, or consumption of other material goods (not to mention energy itself). In short, energy is not the only thing worth conserving.

Under current policy, energy use per unit of economic output has fallen 13 percent in the past four years. This progress seems to be continuing, despite falling real energy prices and a sharp reduction in Government coercion. This certainly was not predicted by critics at the start of the Reagan Administration.

New sources of energy, whether renewable or otherwise, must be judged on their total impact, cost, and side effects, and we believe these decisions can generally best be made at the level of the individual consumer, producer, and (where appropriate) local regulatory authority. We must remember that just because an energy source (solar, nuclear, or other) is said to be inexhaustible, it does not mean it is inexpensive.

IV. Thoughts on Government Forecasting.

If individuals had believed the things in Global 2000 and other recent projections in 1980, they would undoubtedly have invested their money heavily in shut-in oil wells and in cropland. They would, of course, have lost their assets. These losses, however, would have been (and in fact were) balanced by the gains of others who bet the other way. However, when the Government forces all of us to make such investments, we all end up losing our assets.

One may confidently assume that a significant number of individuals and industries suffered financial losses partly as a result of undue dependence on or uncritical acceptance of government forecasts. For example, after a sharp rise in timber and lumber prices in the 1970's, Government agencies predicted continued high prices in view of expected timber shortages and continuing inflation. Acting in part upon such projections, many mills contracted for Government-owned timber at high prices; when timber prices tumbled about 43 percent in real terms from 1979 to 1983, some of these companies, faced with serious losses, demanded relief on the grounds that their trouble stemmed from their reliance on government forecasts. Similarly, many American farmers acted upon Government and other forecasts of continued high inflation, food shortages and rising cropland values by expanding their acreage, often financing these investments by borrowing heavily. When sharply reduced inflation and other factors caused farmland values to drop far below their earlier, speculation-driven levels, many farmers found themselves in a "credit crunch," the effects of which are still being felt. Other private investors suffered losses in the past by relying upon a number of Government forecasts of the late 1970s that the real price of oil and other energy commodities would continue to rise indefinitely.

Based upon this experience, I do not find it at all startling, or even unsettling, that, as the Global 2000 report stated, "The U.S. Government is incapable of accurate and consistent projections about long-term global resource activities." [54] Johns Hopkins political scientist William Ascher studied a range of forecasts by various individuals inside and outside of government and found no advantage to relying upon Government forecasts over private forecasts. [55] In other words, government forecasts are wrong at least as often as private forecasters.

Dangers of Government Forecasting

The key issue surrounding government forecasts is not simply the activity per se, which is subject to the same hazards as private forecasts outlined earlier, but the aura that grows around it when encouraged or sponsored by the Federal Government. Assuming that government forecasts are equally as accurate (or inaccurate) as private forecasts, several special concerns unique to government forecasting immediately arise.

First, projections represented as an "Official U.S. Government Forecast" may acquire an unearned validity. Global 2000 reported that "the United States must improve its ability to identify emerging problems and assess alternative responses." [56] Efforts to improve the accuracy of government forecasting in general, and government global forecasting in particular, generally focus on enhanced centralization of data collection and analysis. Thus, former President Carter, in an address to The Global Tomorrow Coalition in June 1983, recommended steps "to make possible a consistent and coherent vision of pending problems and to recommend to our country how we might best influence our future." He continued:

> A most serious and unmet need is for a coordinating unit within the Federal Government and a joint public-private institution to insure maximum accuracy in collecting data, anticipating future trends, and assuring cooperation in alleviating potential global problems with population, resources and environment. [57]

Any attempt to carry out this recommendation would pose serious dangers. The more the system is "squeezed" to make the estimates "consistent," the more likely they are to be inaccurate. Centralization of modeling in government reduces the opportunity for independent checks upon erroneous programming and inappropriate assumptions. Further, the inevitable desire to have everyone involved in the forecasting exercise agree stifles creativity and undermines the quality of the data and the analysis, and reduces the choices available to potential users of forecasts. While in some instances coherence and consistency may be noble goals, the pursuit of these objectives is ill-advised if it leads simply to analysis that is geared to the lowest common denominator.

A little over a year ago when I had just come to the Energy Department, I reviewed a document designed to summarize our energy security picture for high-level officials, which included an explicit projection of U.S. imports for that year, 1984. I protested that the estimate seemed to be far too high, being 5 to 5.5 million barrels a day of net imports. I was told that yes, there was considerable disagreement over the number, but this was the outcome that could be cleared by all the agencies involved.

As it turned out, actual net imports were about 4.5 million barrels per day. The point of this story is not to extol my own abilities -- it might have turned out to be wrong in the other direction. The point is, rather, that the search for "consistency" can lead to a false implication of certainty.

Perhaps the biggest problem with Government global forecasting as now practiced is that it tends inevitably toward an authoritarian and centralized view of the economy and of life in general. We have just emerged from an era in which fear has been used as a vehicle of power: People will give up goods, money or freedom if sufficiently frightened. For example, the Carter Administration's second National Energy Policy Plan, which offered predictions of continuing energy crisis, spoke of "an urgent need for global, national, State and local management of energy decisions." [58]

Reagan Administration Approach to Forecasting

Former President Carter, who ranks the Global 2000 report as one of the top three achievements of his administration, has charged that:

> Concerted efforts have been made by our government to denigrate the research and projections of the Global 2000 report itself and to block action by the Federal agencies to carry out its recommendations. [59]

While there has been no specific Administration repudiation of the methods and projections of Global 2000, the fact remains that Global 2000 is not a good guide to policy.

With respect to forecasting and modeling, the Administration supports the path most likely to lead to the best analyses, at the lowest possible cost.

Our first priority is to collect good data. In response to the Committee's specific area of query, part of our continuing efforts at the Department of Energy and the Energy Information Administration to maintain and enhance the quality of our data is to work closely with the private sector. Most of the data published by EIA is collected from a variety of private energy firms. Although most data are collected under mandatory authority, the private sector has been very cooperative in maintaining the accuracy and timeliness of its reports. In addition, EIA frequently uses data reported by energy trade associations or trade publications as early indicators of values and trends. Some examples are price data reported by Platt's Oilgram and electricity data reported by the Edison Electric Institute (EEI). Private sector data are also used as a check against EIA data as, for example, in the case of weekly petroleum statistics reported by the American Petroleum Institute (API). In turn, associations such as API and EEI use EIA data as the long-term historical standard upon which their own estimates can be based. Although forecasts by various organizations and EIA are made independently, there is regular communication between forecasting professionals, and EIA regularly publishes a comparison of its forecasts with those made by several private sector groups.

Second, the Administration conducts analyses and forecasts as needed, while remaining aware that government is not intrinsically better at this task than private individuals or groups. We make every effort to encourage diversity of forecasts and analysis. We encourage competing models and analysis and believe that integration of all forecasts or models across the government is neither critical nor advised. In the course of our work, we try to examine almost all of the related measurements and reports, alarming or reassuring. But we do not subscribe to the mindset in some Washington circles that, "if you can't predict right, predict often."

The 1983 National Energy Policy Plan provides a clear statement of Administration policy toward energy forecasts and projections:

> The specifics of future energy prices and production are very uncertain and not subject to precise definition. The projections discussed in this chapter do not necessarily represent Administration policy or the beliefs of the President or the Secretary of Energy. They are, instead, presented in compliance with congressional mandate as one of a number of sets of projections that can be derived from mathematical modeling processes.

> Like other private and government energy projections, the energy projections presented with this 1983 National Energy Policy Plan are inherently uncertain. Because projections cannot fully represent a number of important qualitative factors that influence energy markets -- such as political events, consumer behavior, or policy changes -- these NEPP projections involve a considerable amount of analytical judgment. Thus, the energy outlook presented here should be interpreted as simply a point of departure for understanding future energy development. [60]

Finally, this Administration believes that progress can continue, just as in the past. As Secretary of State George P. Shultz said recently in an address to the National Academy of Sciences, "The technological revolution is pushing back all frontiers on earth, in the oceans, and in space. While we cannot expect these advances to solve all the world's problems, neither can we any longer speak in Malthusian terms of inevitable shortages of food, energy, forests, or clean air and water." [61] In his 1985 State of the Union address, President Reagan spoke of a "Second American Revolution," in which technological and economic progress would usher in an era of expanded hope and opportunity:

> There are no constraints on the human mind, no walls around the human spirit, no barriers to our progress except those we ourselves erect ... [62]

The best policy is based not upon stacks of forecasts, but on a fuller understanding of the forces which shape future events. I am highly critical of long-range modeling, especially large-scale "deductive" models, because of their track record of failure.

An in-depth "intuitive" analysis of key assumptions can be more useful. For example, getting the price elasticity of energy demand straight, and explaining it, is far more useful to decision-makers than forecasts they don't believe anyway. As one analyst has observed, "core assumptions are more crucial than the sophistication of technique." [63]

The historian Macaulay got it about right, over 150 years ago:

> We cannot absolutely prove that those are in error who tell us that society has reached a turning point, that we have seen our best days. But so said all who came before us, and with just as much apparent reason. On what principle is it that, when we see nothing but improvement behind us, we are expected to see nothing but deterioration before us? [64]

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POST-HEARING QUESTIONS AND ANSWERS

Relating to the

APRIL 30, 1985 HEARING

Before the

SUBCOMMITTEE ON GOVERNMENTAL EFFICIENCY AND THE DISTRICT
OF COLUMBIA
of the
COMMITTEE ON GOVERNMENTAL AFFAIRS

and the

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

WITNESS: DANNY J. BOGGS
DEPUTY SECRETARY
DEPARTMENT OF ENERGY

From Page 2 of Testimony:

Q: What other types of decision-making tools do you believe are helpful aids to policy makers (besides computer models)?

A: The most important "tool" an executive branch decisionmaker needs is a clear understanding of the President's policies and a firm conviction to carry them out. Serious damage to a President's agenda can be done by appointees who, in their enthusiasm for specific management processes or analytical methods, lose sight of their primary responsibility: to carry out the policies of a popularly elected President.

On a more technical level, I believe that sound policy is based on good data and the means to organize these data in a useful fashion. Besides computer models, these methods might include various statistical and accounting conventions, among other things.

From Page 2 of Testimony (continued)

Q: What other types of decision-making tools do you believe are helpful aids to policy makers (besides computer models)?

-- what types do you as a decision-maker use?

A: At the Department of Energy we tend to use a fair number of computer models in our attempts to understand the possible effects of various policy proposals on all aspects of the energy market, including energy price, supply and demand.

We also tend to avoid saying with conviction that if "X" happens, "Y" is sure to follow. Instead, Department analysts generally supply their best estimates of a range of possible outcomes, given a certain set of conditions, as well as provide an explanation of the assumptions used to derive this range of results.

From Page 2 of Testimony (continued)

Q: -- What types does the DOE use?

A: The Department of Energy considers a broad range of input, from both the public and private sectors, in its deliberations over energy policy. In addition to the results of complex computer simulation models, other techniques such as simpler stochastic models, straightforward applications of microeconomic theories and principles, and reviews of trends in relevant data elements often provide valuable information. Studies and reports provided by private groups may contain data series not previously considered, or alternative analytic approaches of interest to the federal policymaker.

From Page 2 of Testimony (continued)

Q: -- Is there not a high degree of uncertainty associated with these tools?

A: As I stated in my testimony, there is a tremendous amount of uncertainty associated with all forecasts -- both public and private. Therefore, I believe it is all the more helpful for the Government to provide sound data and promote general understanding of the underlying forces which shape the future.

From Page 5 of Testimony:

Q: Is extreme simplification the price forecasters must pay for operating at the global model level with large aggregate numbers?

A: Naturally, extreme simplification overlooks a substantial amount of detail. Thus, a "simple" global model may be ill-equipped to account for large changes in "small" variables. As such, the model could in fact be useless.

But that does not mean that the reverse is necessarily true. A global model which attempts to account for a large number of variables can collapse under the weight of its own detailed assumptions. This is especially true if the model is actually driven largely by a few of the equations and assumptions and they turn out to be wrong.

From Page 5 of Testimony (continued)

Q: You note you are skeptical of forecasts used to justify government decision-making which is best left to "the discretion of free, rational citizens." Do you have some specific examples of such a situation in mind?

A: Certainly, the whole history of energy forecasts, in the 1970s, in which alarmist projections of "gaps" were used to justify all kinds of counterproductive controls (oil and natural gas price controls especially) and what proved to be wasteful subsidies, are a very good example. Another example is forecasts of impending resource shortages being used to justify controls on the private use of such resources.

From Page 5 of Testimony (continued)

Q: Isn't there also value to the nation in avoiding dependence on foreign sources of oil? And isn't this value above and beyond the simple price we pay for oil? This government has acknowledged the military responsibility for defending foreign sources of oil; shouldn't it also take responsibility for peaceful means of reducing vulnerability to oil disruption?

A: Reducing U.S. dependence on foreign imports of oil remains a critical challenge. The value of reducing our vulnerability is indeed above and beyond the price we pay for oil. The most effective means for accomplishing this is in exploiting all of our energy resources, including conservation, diversifying our sources of supply, and maintaining our Strategic Petroleum Reserve (SPR). U.S. energy policy takes into account both these economic and security objectives. The two objectives should be inseparable because, as demonstrated by the recessionary impact of the oil price shocks of the seventies, we can be as vulnerable to the price of oil as we are to physical disruptions of the supply of oil.

The goal of our energy policy, therefore, is to achieve energy stability, security, and strength by fostering an adequate supply of energy at reasonable costs.

From Page 5 of Testimony (continued)

A: (continued)

The strategies are: first, to minimize federal control and involvement in energy markets while maintaining public health and safety and environmental quality; and second, to promote a balanced and mixed energy resource system.

The market is much more effective in determining flows and prices of oil and other forms of energy than any other mechanism. Oil prices have dropped steadily since oil deregulation in 1981. Natural gas prices are declining as a result of partial deregulation and other actions by the Government to put the transportation of gas on a more market-oriented basis.

The combination of market forces and large, quickly available oil reserves in the SPR are the most effective tools in an emergency. The SPR will have 489 million barrels of crude oil by the end of September 1985, and can be drawn at the rate of 2.3 million barrels per day. This level represents the equivalent of over 110 days of our net imports in 1985. Since 1979, net U.S. oil imports --excluding the SPR -- have fallen by almost 45 percent, and U.S. oil imports from Arab OPEC suppliers have decreased by almost 75 percent.

From Page 12 of Testimony:

Q: On page 12 you mention that certain world food forecasts have been too gloomy, and you say that "world food production per capita has already increased about 15 percent; current world grain production per capita is the highest in history." But do you really mean to imply that all is well in world food production? Can you ignore that per capita food production in Africa has declined by 15 percent since 1967?

A: With regard to question four, my statements meant to imply exactly what they say. Of course, "all is not well" in world food production. Areas where per capita production has declined would prefer that it had increased. Areas where it has increased by even more than the average may wish that it increased yet further. But it is generally those who wish to imply that "nothing is well" who ignore the actual facts.

Further, I doubt that any significant number of either agriculture or development experts believe that declining per capita food production in Africa has very much to do with resource constraints or population pressures when the results have been so different in Latin American and Asian countries facing exactly similar conditions.

From Page 14 of Testimony:

Q: Your testimony notes the unreliability of certain data in global models -- the G.I.G.O. problem -- "garbage in, garbage out." Identify regions of the world where data unreliability poses such a serious problem to your mind that forecasts become meaningless. what types of data are unreliable?

A: Significant problems are: Forecasts based on data which are simply anecdotal or hypothetical and which subsequently get radically revised upon contemplation. Some examples of this type include rates of forest depletion, species extinction, or ozone depletion. Other models take a particular bad condition, such as high infant mortality rates, and do not actually analyze whether that is an improvement over past conditions, before creating an assumed rate of change for a model.

Another significant problem is limitations within a model on assumed rates of improvement or assumed ultimate possiblities in such areas as food production, resource prices, etc. Frequently these items are input to a model as givens, or allowed to vary only within fairly narrow ranges. Instead, reality has turned out in the past, and will in the future, to provide much more hopeful outcomes.

From Page 14 of Testimony (continued)

Q: Your testimony indicates that while you do believe forecasting is at best a questionable function of government, that government does have a strong interest in assuring a supply of credible data on subjects of public policy. Since government will continue to attempt to understand how the world and the nation function, data collection and some degree of analysis seem an inevitable need, as you seem to agree. In fact, as you have indicated, much of the problem in forecasting efforts hinges on inadequate data.

However, since 1980, the eight major Federal statistical agencies* have lost 21 percent of their budgets in constant dollars. The Energy Information Agency alone has gone from $90.8 million in 1980 to a requested $41.5 million in 1986, with virtual decimation of their long-term forecasting ability.

(*The eight agencies are: Census Bureau, Bureau of Labor Statistics, Energy Information Administration, Statistical Reporting Service of USDA, National Center for Health Statistics, Bureau of Economic Analysis, Bureau of Justice Statistics, Center for Education Statistics.)

How do you reconcile this with the need for better data which you have identified?

A: Since 1980, the resources needed to support the Energy Information Administration (EIA) have declined sharply, in large part due to the President's order of January 28, 1981, to decontrol crude oil and petroleum product prices. As a result of this executive decision, the EIA was no longer burdened with the collection, analysis, and interpretation of a wide variety of information.

From Page 14 of Testimony (continued)

A: (continued)

This savings, however, should not overshadow the more effective fiscal restraint measures exercised by EIA management. Through eliminations, consolidations, and refinements of energy data, the EIA has been able to maintain its core information responsibilities while recording significant savings in manpower and dollars. The overall result has been better data and better analysis.

With respect to the EIA's "long-term forecasting ability," it should be noted that there are no facts about the future. Accurate predictions of what will happen tomorrow are difficult to make; trying to predict accurately what will happen in years and beyond is nearly impossible. The EIA's decision to eliminate the majority of its forecasts beyond the turn of the century was based, therefore, on practical rather than budgetary reasons. The EIA continues to maintain and attempt to improve its capabilities to forecast energy trends over the next ten years.

From Pages 15 and 16 of Testimony (continued)

Q: On Pages 15 and 16, you mention that infant mortality declined at different rates over different periods, and you seem to belittle the National Center for Health Statistics for expressing concern for lack of progress during one such period. You cite the resumption of a decline in mortality later as an indication that their concern was more a failure of observation than a legitimate concern. By this you seem to imply that improvements just happen naturally and that the medical profession should not worry when progress lags, that eventually things will just get better on their own. Isn't it likely that by monitoring trends medical personnel have acted to improve the health of our population?

A: I certainly did not "belittle" NCHS for "expressing concern." Rather, I indicated that the implicit interpretation by many that things had fundamentally changed and would not or could not get better was wrong. Certainly monitoring conditions, and attempting to analyze when those conditions are not following the trend that current theory would indicate they should follow, is a useful exercise. Things almost never "get better on their own," they get better because of the actions of people to make them better. The question usually is, however, whether those needed actions involve coercive government activity, or whether such activity is not more frequently counterproductive.

From Pages 15 and 16 of Testimony (continued)

Q: What is your view of the future with respect to the sources, types, supply, demand, and prices of energy to the Year 2005?

A: Preliminary energy projections developed for the 1985 National Energy Policy Plan (Reference Case) indicate primary energy consumed in the U.S. between 1984 and 2010 is expected to increase at about 1.4 percent per year, significantly less than the 2.7 percent projected annual rate of U.S. economic growth during that period.

Increased investment in oil and gas development will maintain domestic production of these fuels at about current levels through 1990. Beyond 1990, oil and gas are likely to become increasingly difficult to find and develop. Coal, nuclear, and renewable energy use are projected to increase substantially over the long term, although short term low energy prices will tend to dampen growth in production.

Since considerable uncertainty is attached to these projections of future energy trends, they cannot be the sole basis for future planning. The range of these and other energy projections and expert opinions, however, are sufficient to warrant two conclusions: 1) our energy future will continue to be marked by uncertainty; and 2) flexibility (which is best provided by relying on market forces and on the availability of a balanced mix of energy resources) offers the greatest opportunity for ensuring an effective response to uncertain conditions.

From Pages 15 and 16 of Testimony (continued)

Q: What, if any, changes do you see occurring between now and then which will bring us to that Year 2005 future?

A: Much uncertainty underlies projections of future energy consumption, production and prices. These projections are based upon a series of macroeconomic and energy market assumptions as well as our current view of the energy world. These assumptions include expected future economic growth rates for the U.S. and other regions of the world, estimates of international fossil fuel resources, expected energy efficiency improvements both here and abroad, future OPEC and non-OPEC crude oil production capacities, and various U.S. domestic macroeconomic factors. Each of these factors has a major effect on projected energy trends, but each is also subject to a large degree of uncertainty. As a result, the projections themselves are also subject to uncertainty.

Our current view and understanding of the energy world is also subject to change. The oil price shocks of the 1970s profoundly altered our view of the energy market and our energy future; and future events could alter our basic assumptions about energy markets and trends.

From Pages 15 and 16 of Testimony (continued)

A: (continued)

Overall, we expect to see a continuation of increased energy efficiency trends in all sectors of the U.S. economy. Considerable fuel switching and decline of certain energy-intensive industries may also continue to occur in response to the demand to maintain and improve environmental conditions.

Finally, energy markets responding to price signals will continue to shape our energy future. The factors that determine energy supply and demand are changing constantly. Market forces are far superior to any alternative way of allocating energy resources by permitting prompt, decentralized and flexible responses to a dynamic economy and in reaction to unpredictable international events.

As a result of these assumptions and expected market changes, world oil prices are projected to remain relatively low through 1990 and then may increase. Natural gas prices will remain low enough so that gas will compete successfully with oil on the margin.

From Pages 15 and 16 of Testimony (continued)

Q: What future energy sources and uses of energy do you foresee after the world supply of oil and gas is exhausted?

-- or do you believe the supply is inexhaustible?

A: The world is already using a large number of sources of energy other than oil and gas. In my view, the likely future course is for those other sources to become increasingly used if and to the extent that the available supplies of oil and gas rise in price relative to those other resources. Our present knowledge appears to be that coal is in much greater physical abundance than oil and gas. Other sources, which may be practically inexhaustible, include solar, geothermal based on the internal heat of the earth, nuclear fission using breeders, and fusion. There may also be other sources not yet conceived of. However, as "inexhaustible" does not necessarily imply inexpensive, the rate at which these resources will be substituted for exhaustible ones will depend on price, demand factors, and other characteristics of use and acceptability.

From Pages 15 and 16 of Testimony (continued)

Q: Why is the Department not pursuing solar energy for domestic, residential and commercial use in a concerted fashion as a fail-safe supply of domestic energy?

A: Today solar energy systems are being used throughout the Nation. Solar systems are providing space and water heating, as well as cooling for buildings. Solar energy can also be used to generate electricity for use in homes, offices and factories.

The principal responsibility of the Department toward ensuring security and stability of the Nation's energy future is to support long-term, high-risk research and development. The resulting knowledge broadens and strengthens the technology base which enables industry to bring efficient, cost effective and environmentally acceptable new energy resources and technology options into the marketplace. Through the Department's technology transfer efforts, the private sector is informed of the availability of solar and energy conservation systems for use in both their homes and businesses.

From Pages 15 and 16 of Testimony (continued)

Q: What is your view of the role of government with respect to the development of new energy sources, technology, and conservation methods?

A: The energy policy of this Administration is to promote an adequate supply of energy at a reasonable cost. In this context, the role of the government is to create an environment in which new energy sources and technologies, including conservation, are chosen, developed, and applied in a free, fair, and efficient market. The role of direct government funding is best employed in supporting high-risk, long-term, high-payoff basic research.

From Pages 15 and 16 of Testimony (continued)

Q: When you use the term "long range" with respect to foresight, what number of years are you referring to?

A: The phrase "long range" does not imply a specific period of time. In industry, it can mean sales and manufacturing plans for the next few years, while in a global context it could refer to an environmental problem extending over many decades. Thus, the length of time implied by "long range" is dependent on the context in which it is used. For example, my comment on Page 16 about "long-run" increase in world grain production implies a period on the order of five years or more.

From Pages 18 and 19 of Testimony:

Q: On pages 18 and 19, you seem to imply that the Asian food situation has improved without benefit from policy analysis. But are you aware that major improvements made in food production in a large part of Asia, in India, came about specifically because of a vast food shortage there, coupled with U.S. efforts to change India's agricultural policy in return for food aid? Yet, you seem to be saying that because the potential disaster did not occur that policy analysts and forecasters were wrong. The truth is, that catastrophe was avoided exactly because people were doing the kind of analysis that you seem to disdain so strongly.

A: I specifically do not agree that it required any great policy analysis to impress upon Asians that they were not growing enough food or that they would be better off if they grew more. The types of analysts I was citing in my testimony were certainly not people who argued that India could grow enough food for itself (and for export to Russia!) if it would only adopt a more free market policy. Rather, they tended to argue that it was impossible for India to grow enough food and that salvation lay only in radical population control measures. For example, William and Paul Paddock, in their seminal book, "Famine 1975!", title one portion "The Inevitability of Famine in the Hungry Nations." They specifically cite India as being first among the nations on the brink of disaster, and place it in the category of "can't be saved," no matter how great the use of food aid (!).

From Pages 18 and 19 of Testimony (continued)

A: (continued)

I would certainly not denigrate the role of analysis in indicating what type of government policies allow for a bettering of human condition, or of what private policies can lead to the best economic outcome.

From Page 31 of Testimony:

Q: You cite the failure of most forecasts to anticipate the drastic decline in timber prices and the change in energy consumption of the early 1980s. However, these changes were the direct result of the deepest recession since the Great Depression, brought on by Federal Government policies.

Such drastic and unexpected turnarounds in public policy cannot always be factored into projects. Do you think these are fair examples for you to use when the adverse and unexpected changes in timber prices were caused by goverment policies?

A: Your basic hypothesis in the first paragraph is completely incorrect. The United States is now in the midst of its strongest recovery in many years, and all indices of national income and productivity, even on a per capita basis, are at all-time highs. Yet lower timber and energy prices and relatively lower energy consumption persist. Thus, it is not true that the recession was the only or major cause of these changes.

It is certainly true that reducing inflation has a drastic effect on nominal prices. However, it is a very poor and simple-minded forecast that tells us that nominal prices will continue to rise if the government keeps printing more money. Virtually all forecasts also predicted substantial increases in real prices, which has simply not occurred.

From Page 31 of Testimony (continued)

A: (continued)

In fact, it is the very possibility of significant change in government policy, especially bad government policy, that makes forecasts of inevitable doom so hazardous.

Incidentally, it seems rather unfair to make a great deal of "the deepest recession since the Great Depression" when the decline in real GNP at the depths of that recession was 2 percent, compared to 25 percent at the depths of the Great Depression.

From Page 31 of Testimony (continued)

Q: You warn in your testimony against the tendency for government projects and forecasts to be treated with undue respect. The fact remains that private forecasts and projections are either proprietary or doneby expensive consulting firms. They are simply not available to small operators or someone who is planning a new small business.

Does not government have a responsibility to provide both reliable data and forecasts, since they are the only openly available to the public?

A: I fail to see how an entrepreneur can be grossly handicapped in the process you describe. Many useful assessments of current conditions and possible trends are available inexpensively -- a subscription to a single business-oriented magazine is often all the "forecasting" a small businessman needs.

In a free economy, one must accept the fact that there are risks and rewards associated with every investment. Your question implies that the government can significantly minimize these risks by issuing forecasts. Most government agencies (Energy, Agriculture, Commerce) do issue short-run forecasts, but it is not clear how often they qualify as "reliable."

Question 1.

Turning now to The State of the World: 1985, a Worldwatch Institute Report, does the Department's global energy model support the Worldwatch contention that "Worldwide commercial energy demand will increase from about 300 exajoules (EJ) in 1983 to 485 by the year 2000?" (p. 148)

-- why or why not?

A: The Worldwatch Institute did not forecast world energy consumption would rise to 485 exajoules by 2000. As indicated in their study, the figure cited only represented a "consensus" derived from another study. Table 7-6, of The State of the World: 1985, forecast world energy consumption in the year 2000 at 360 exajoules.

The global energy model (International Energy Evaluation System-IEES) was retired by EIA several years ago. The energy policy model used to develop energy projections in support of the 1985 National Energy Policy Plan (NEPP) analyses free-world energy production and consumption, and energy trade with countries with Centrally Planned Economies (CPE's). The preliminary NEPP projections (Reference Case) indicate about a 30 percent increase in free-world energy consumption by 2000.

Question 1 (continued)

A: (continued)

While our energy forecasting tools and capabilities have increased considerably over the last 10 years, any long term projections, including ours, will remain subject to many unpredictable events such as technological change, weather, oil supply disruptions, etc. As such, there will always be a high degree of uncertainty in making long-run forecasts.

Question 1.

Turning now to The State of the World: 1985, a Worldwatch Institute Report, does the Department's global energy model support the Worldwatch contention that "Worldwide commercial energy demand will increase from about 300 exajoules (EJ) in 1983 to 485 by the year 2000?" (p. 148)

-- what is the Department's projected figure of worldwide commercial energy demand for the year 2000?

A: Energy projections developed for the 1985 National Energy Policy Plan (Reference Case) indicate free-world energy consumption in 2000 is expected to be about 285 quads. This does not include energy consumed in countries with Centrally Planned Economies (CPE's). Because of generally unreliable historical energy data and difficulties in modelling economic activity in these countries, energy production and consumption by CPE's are not explicitly included in the analysis, and only the net energy trade from these countries is included as an assumption.

Question 1.

Turning now to The State of the World: 1985, a Worldwatch Institute Report, does the Department's global energy model support the Worldwatch contention that "Worldwide commercial energy demand will increase from about 300 exajoules (EJ) in 1983 to 485 by the year 2000?" (p. 148)

-- what variables or assumptions does the Department's model make to arrive at its projected demand for the year 2000?

A: Since the purchase and use of goods and services is related to the amount of economic activity in an economy, the gross domestic product (GDP) of a nation is a major indicator of that nation's energy demand. The economic growth assumptions used in the projections developed for the 1985 National Energy Policy Plan were based upon a review of a number of economic forecasts. The resulting input assumptions are shown in the following Table:

	GDP INDEX (1984=1.0)						MAXIMUM SUSTAINABLE OPEC CAPACITY[a] (MMBD)		NET CPE EXPORTS (MMBDOE)		
	OECD										
YEAR	U.S.	OTHER	AVERAGE	OPEC	REST OF FREE WORLD	AVERAGE	LOW	HIGH	OIL	GAS	COAL
HIST.											
1970	0.659	0.773	0.724	0.329	0.665	0.606	N/A	N/A	0.8	0.1	0.3
1975	0.747	0.919	0.845	0.553	0.816	0.820	39.3	39.3	1.1	0.1	0.4
1980	0.894	1.079	0.999	0.762	1.013	0.985	33.5	33.5	1.2	0.4	0.5
ESTI.											
1984	1.000	1.000	1.000	1.000	1.000	1.000	20.5	29.0	1.9	0.4	0.4
PROJ.											
1990	1.259	1.156	1.198	1.278	1.277	1.218	28.5	35.0	0.5	0.5	0.5
1995	1.411	1.283	1.335	1.629	1.586	1.403	32.0	37.0	0.0	0.8	0.6
2000	1.586	1.436	1.497	2.030	1.995	1.625	32.0	40.5	0.0	1.3	0.7
2005	1.777	1.588	1.671	2.471	2.423	1.864	32.0	41.0	0.0	1.7	0.8
2010	1.985	1.787	1.871	3.007	2.955	2.148	32.0	41.0	0.0	1.8	1.1

a) Includes natural gas liquids (NGL).

Question 1 (continued)

A: (continued)

We assume that one of the most useful indicators of world oil price movements is OPEC oil capacity utilization (production divided by production capacity). As demand for OPEC oil increases, OPEC capacity utilization also increases. When OPEC capacity utilization approaches a certain level (about 85 percent), OPEC is assumed to raise prices in order to bring actual production levels into line with desired production levels. Thus, strong upward price pressures exist when OPEC capacity utilization exceeds about 85 percent. Assumptions about OPEC capacity are therefore critical in projecting world oil price behavior.

Although energy production and consumption by the Centrally Planned Economies (CPE's) are not explicitly included in the analysis, the net energy trade from these countries is included as an input assumption. Additional information on assumptions and results of our analysis will be available in the Energy Projections Appendix to the 1985 National Energy Policy Plan to be forwarded to the Congress later this year.

Question 1.

Turning now to The State of the World: 1985, a Worldwatch Institute Report, does the Department's global energy model support the Worldwatch contention that "Worldwide commercial energy demand will increase from about 300 exajoules (EJ) in 1983 to 485 by the year 2000?" (p. 148)

-- what assumptions does the Department's model make about U.S. demand for energy as a share of world demands?

A: In the model used to develop the energy projections for the 1985 National Energy Policy Plan, no assumptions are made about the U.S. share of free-world energy use. The results of our analyses indicate the share is expected to be about 34 percent by 2000 (in 1984 it was about 38 percent).

Question 1.

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-- What assumptions about U.S. energy conservation patterns and levels does the model make? Will U.S. conservation increase, stay about the same, or decrease?

A: Energy conservation will continue to make significant contributions to the Nation's increasing energy efficiency, and these contributions are included in the assumptions used in the National Energy Policy Plan forecasts.

There are many assumptions used in these forecasts, some of the most salient include: consumer discount rates for energy consuming equipment in each sector of the economy, process efficiencies of numerous processes in the industrial sector, and vehicular efficiencies by mode in the transportation sector.

The projected energy efficiency trends in each sector of the economy are detailed in the attached Table.

NEPP-1985 REFERENCE CASE — U.S. ENERGY CONSERVATION TRENDS

17-Oct

	REFERENCE ASSUMPTIONS					TOTAL END-USE ENERGY CONSUMPTION (QUADRILLION BTU's)					UNIT END-USE ENERGY CONSUMPTION				
YEAR	GNP (BILLION 1984$)	HOUSING STOCK (MILLION)	COMMERCIAL FLOOR SPCE (BILLION SQ. FT.)	INDUSTRIAL PRODUCTION INDEX (1984=100)	TOTAL VEHICLES (MILLION)	RESI-DENTIAL	COM-MERCIAL	INDUS-TRIAL	HIGHWAY TRANS-POR-TATION	TOTAL[a)]	RESI-DENTIAL (MILLION BTU PER HSHLD.)	COM-MERCIAL (THOUS. BTU PER SQ.FT.)	INDUS-TRIAL (QUADS/ OUTPUT 1984=100)	TRANSPOR-TATION (MILLION BTU PER VEHICLE)	TOTAL (THOUS. BTU PER $1984 OF GNP)
HIST.															
1960	1643	53.0	15.8	40.2	69.1	7.2	3.5	18.3	7.4	39.5	135.8	221.5	195.1	107.1	24.0
1965	2071	58.0	20.3	54.6	83.7	8.3	4.2	21.8	8.9	46.5	143.1	206.9	171.1	106.3	22.5
1970	2420	63.5	24.3	65.6	99.3	10.0	5.6	25.3	11.6	56.7	157.5	230.5	165.3	116.8	23.4
1975	2745	72.5	28.3	71.8	121.0	10.0	5.6	24.0	13.8	57.8	137.9	197.9	143.3	114.0	21.1
1980	3285	80.4	31.6	84.5	140.6	10.3	6.0	25.0	14.5	61.0	128.1	189.9	126.6	103.1	18.6
ESTI.															
1984	3663	84.1	34.3	100.0	149.1	9.8	6.1	22.6	14.5	58.5	116.6	176.2	100.0	97.5	15.0
PROJ.															
1990	4612	91.5	42.5	137.8	170.8	10.8	7.1	28.0	13.5	64.9	117.7	168.2	89.7	79.2	14.1
1995	5170	96.4	47.1	157.1	188.4	11.2	7.7	29.3	13.6	67.4	115.8	164.4	82.6	72.3	13.0
2000	5808	101.5	52.6	179.6	207.4	11.3	8.3	30.1	14.6	70.1	111.2	157.1	74.0	70.2	12.1

a) Total includes non-highway transportation energy use.

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Question 1.

Turning now to The State of the World: 1985, a Worldwatch Institute Report, does the Department's global energy model support the Worldwatch contention that "Worldwide commercial energy demand will increase from about 300 exajoules (EJ) in 1983 to 485 by the year 2000?" (p. 148)

-- What assumptions about world energy prices does the model make (up; down; level) between now and the year 2000?

A: Again, projected energy prices are an output of our analyses, not an input assumption. Projected world oil prices are:

Year	1984 Dollars Per Barrel
1984	$ 28.98
1990	28.65
1995	35.02
2000	43.80

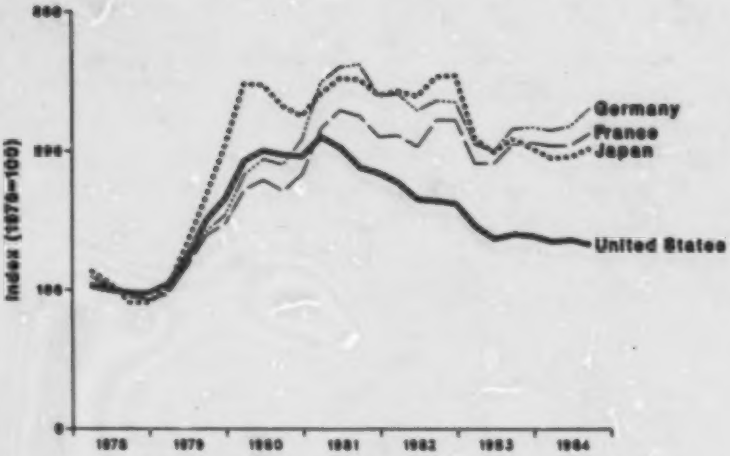
As indicated in the previous National Energy Policy Plan, these figures, even when final, are supplied in response to congressional mandate, and do not necessarily represent the beliefs of any responsible official of the Department of Energy.

Question 2.

Isn't it true that much of the fall in the price of oil is an illusion -- created by the phenomenal strength of the dollar which is a direct result of historically high deficits? Is it not a fact that oil is at near-record price levels for our allies and for the debt-ridden Third World -- because they pay in enormously inflated dollars inflated by the deficit?

A: The fall in the price of oil has not been an illusion. The U.S. composite refiner acquisition cost of crude oil has fallen in nominal terms since its peak in 1981 from $35.24/barrel to about $27.00/barrel during the first quarter of 1985, a decline of 23 percent. After accounting for inflation, the composite refiner acquisition cost has fallen by 35 percent in real terms from 1981 to the first quarter of 1985. For many countries, the fall in the nominal dollar price of oil has been offset by the strength of the dollar such that the nominal price in local currencies has not declined as much as the nominal dollar price. However, considering local inflation, real prices in local currency have also fallen in almost every country. See the attached chart (Figure 14) from the latest Annual Energy Outlook of EIA.

Figure 14. Real World Oil Prices in Major Industrial Countries Based on National Currencies, 1978-1984



Note: The average refiner acquisition cost of imported crude oil in the United States is used as the world oil price for each country. The world oil price is converted to the national currency by using the appropriate exchange rate. This value is then converted to an index by dividing each quarterly value by the average value for 1978. Inflation rates for each country are used to determine real prices.

Source: Energy Information Administration, Monthly Energy Review, DOE/EIA-0035(84/06) (Washington, DC, 1984); International Monetary Fund, International Financial Statistics (Washington, DC); Data Resources, Inc., U.S. Central, Europe, and Japan data bases.

Question 3.

Do you agree that "enormous potential for cutting energy costs still remains in existing (industrial) plants, and builders of new production facilities can choose equipment and processes that are considerably more efficient than those already in use?" (p. 250)

If so, what policies, regulations, and incentives is the Department pursuing to encourage further energy conservation by industrial plants?

A: Between 1972 and 1983, the cumulative energy efficiency improvement reported by the industrial sector is 26.2 percent. There is still significant potential for further cutting of energy costs in both existing and new industrial facilities. Many of the technologies required to do this are currently available.

The Department operates a number of programs designed to encourage further energy efficiency improvements. For example, DOE supports research and development on advanced energy-efficient technologies for the industrial sector. We have also supported an energy audit assistance program for small and medium size plants, which continues to identify many conservation opportunities with return on investments in excess of 100 percent. In addition, we have an active technology transfer program to insure that the results of all Federally funded research are disseminated to the appropriate industries.

Question 4.

Mr. Boggs, referring again to the Worldwatch Institute report, you say, on page 28, 'Flavin and Pollock conclude their chapter with a recommendation that is somewhat consistent with current Administration policy...' (to) create a level playing field on which renewable and conventional resources can compete economically.'

Can you confirm press reports that the Administration, in the new draft tax reform legislation, has decided to eliminate tax credits for energy conservation and solar energy while continuing the oil and gas depletion allowances?

Does this make for a level playing field and letting the market work?

Is the proposed tax bill consistent with your statement on page 30 that, "New sources of energy, whether renewable, or otherwise, must be judged on their total impact, cost, and side effects, and we believe these decisions can generally best be made at the level of the individual consumer, producer, and (where appropriate) local regulatory authority?" Doesn't our tax system skew the free market operations and the decisions of rational individuals by favoring certain forms of energy development?

A: The President's tax simplification plan (released May 1985) does not make any proposals to change current law concerning those renewable energy and energy conservation tax credits that are scheduled to expire on December 31, 1985.

The President's tax reform proposal eliminates the percentage depletion allowances now received by independent producers and royalty owners, except for the producing portions of oil and gas stripper wells.

Question 4 (continued)

A: (continued)

These provisions of the President's tax proposal will enhance efficient use of our natural resources while supporting our energy security needs. The limited availability of the percentage depletion allowance will prevent many marginal wells from being permanently abandoned, affecting about ten percent of our annual production. Were we to permit this to happen, our dependence on imported oil would increase.

The market will continue to promote cost-effective development of renewable energy and conservation as well as our non-renewable energy resources. Maintaining stripper well production will not lower the market price of oil or tilt the playing field away from renewables. The President's tax simplification proposal will lower tax rates, provide greater incentives for capital formation, and result in a more efficient economy where energy options can compete on their own merits. In the long run, a more productive and innovative economy is the best spur to new technologies, including conservation and renewable energy technologies.

Question 4 (continued)

A: (continued)

We believe the President's Tax Proposal encourages efficient decisionmaking by consumers and producers of all energy forms. The plan balances our energy security needs against the benefits of tax simplification and fairness, and supports our basic energy goals of minimizing federal control of energy markets while promoting a balanced and mixed energy system.

Question 5.

On page 35 you make a commendable statement: "Our first priority is to collect good data." How does this statement jibe with the proposed OMB rule described in "Management of Federal Information Resources", (Federal Register, Vol. 50 No. 51, p. 10734) that restricts all data collection by the government to that specifically mandated by Congress?

A: The Department of Energy has commented on several issues raised by the proposed Office of Management and Budget Circular on Federal information gathering. A major issue is the fundamental difference between organizations whose primary mission is information collection and dissemination, such as the Energy Information Administration (EIA), and those organizations involved in program management and related activities, such as the Office of Defense Programs.

The law is clear concerning the Energy Information Administration's responsibilities and authorities to maintain its independence in carrying out a central, comprehensive, and unified energy data and information program. The legislative charge given the EIA Administrator requires him in some instances to collect quite specific data and in other instances to exercise his

Question 5 (continued)

A: (continued)

discretion in determining the Nation's energy information needs. Pending resolution of the issues raised in response to the Office of Management and Budget proposed circular, I cannot say that the rule would create a conflict in meeting our priority to collect the best possible data.

Question 6.

What is your view of the effectiveness of the Cabinet Council on Natural Resources and Environment, in coordinating policy in these areas, highlighting problem areas, initiating new ideas, and sharing these views with the President? Have I characterized the role of the Cabinet Council system accurately?

A: I would say that you have accurately described the role of the Cabinet Council system. It was my experience as Executive Secretary of the Cabinet Council on Natural Resources and Environment that the system served the President well. Our contribution, I believe, was especially important in the first years of a new Administration.

Question 7.

What types of policy initiatives with respect to environment and natural resources have been shared with the President by the Cabinet Council and were they endorsed, adopted, or otherwise acted upon by the President and affected Departments?

A: You seem to imply that the Council was an autonomous executive body. That was not the case. The Council was a forum for a number of the President's appointees to meet, share concerns and ideas, flesh out options for the President's consideration and where possible, forge Administration consensus on the best advice we could give to the President. The Council did not have special powers aside from those residing in various Departments under law, or delegated to various individuals by the President.

Policies on numerous subjects, including natural gas deregulation, offshore oil leasing, acid rain, coal slurry pipelines, and Alaskan natural gas, were presented through the Council for ultimate decision by the President.

Question 7.

Would you characterize those policies which emerged from the Cabinet Council as major departures from previous policies?

A: In many cases. The energy policies of the previous Administration, for example, were fundamentally opposed to the best interests of the American people. The Cabinet Council reflected the philosophy of Ronald Reagan, and helped formulate policies consistent with this philosophy.

I would note that the President's 1984 landslide victory would suggest that the American people supported these "major departures" from the failed policies of the past.

Question 7.

If so, what new information, assumptions, or variables did the Cabinet Council have at hand to arrive at these new policies?

A: We had a vast supply of evidence that Carter Administration policies were not working. A sample: interest rates hit a post-Civil War record high; inflation was in double digits for two years; and America was meeting nearly half her oil needs through imports.

Question 8.

According to April 12 news accounts, a new Domestic Policy Council and a new Economic Policy Council have been created. These appear to be a return to the White House policy organizations of the past.

I gather this puts the Cabinet Councils out of business. Could you shed some light for us on this reorganization?

-- Why were the seven Cabinet Councils abolished or reorganized?

-- How will their policy areas be represented on the two new Councils?

A: Two Cabinet-level bodies -- the Economic Policy Council (EPC) and the Domestic Policy Council (DPC) -- have replaced the seven Cabinet Councils and the Senior Interagency Group on International Economic Policy. The EPC advises the President on all aspects of national and international economic policy. The DPC advises the President on domestic and social policy. The new entities streamline policy development and decisionmaking. Along with the National Security Council, the EPC and the DPC serve as the primary channels for advising the President on policy matters.

A more fragmented decisionmaking process, with several departments or task forces reporting separately to the President, places the burden of integrating policies

Question 8 (continued)

A: (continued)

almost entirely on the President. A high-level coordinating entity can assist the President by focusing on broader issues and ensuring that all effects of policy options are considered.

Question 8.

According to April 12 news accounts, a new Domestic Policy Council and a new Economic Policy Council have been created. These appear to be a return to the White House policy organizations of the past.

I gather this puts the Cabinet Councils out of business. Could you shed some light for us on this reorganization?

-- Will the Department of Energy be represented on both these Councils?

  - by whom?

A: DOE is a member of the Domestic Policy Council, and attends the Economic Policy Council when energy matters are discussed. The Secretary or Deputy Secretary represents the Department.

Question 8.

According to April 12 news accounts, a new Domestic Policy Council and a new Economic Policy Council have been created. These appear to be a return to the White House policy organizations of the past.

I gather this puts the Cabinet Councils out of business. Could you shed some light for us on this reorganization?

-- Who represented the Department and on which of the seven Cabinet Councils in the past?

A: In the first term, the Department of Energy was represented in the Cabinet Council on Natural Resources and Environment, the Cabinet Council on Commerce and Trade, and the Cabinet Council on Management and Administration. The Secretary, Deputy Secretary or Acting Secretary represented the Department at the Cabinet Council level.

Question 8.

According to April 12 news accounts, a new Domestic Policy Council and a new Economic Policy Council have been created. These appear to be a return to the White House policy organizations of the past.

I gather this puts the Cabinet Councils out of business. Could you shed some light for us on this reorganization?

-- Will the Global Issues Working Group continue to function? To whom will it report?

A: Currently, the Global Issues Working Group is one of a number of sub-groups under a general working group on Energy, Environment and Natural Resources, established on September 25, 1985, which Attorney General Meese, Chairman Pro Tem of the Domestic Policy Council, has named me to chair.

Question 9.

The Department's Fiscal 1986 budget proposes a halt to the filling of the Strategic Petroleum Reserve. Is this a temporary one-year halt or something more long-term?

If it is long-term, what assumptions has the Department made about the world supply, demand, and prices of oil during that period of time?

A: It is the policy of this Administration that decisions concerning the rate of fill of the Strategic Petroleum Reserve (SPR) should reflect a balance between the benefits of further additions to the existing inventory and Federal fiscal conditions. It should also be recognized that as the SPR inventory has become larger, the incremental value of additions to the inventory diminishes. Future SPR fill decisions should not be automatic or absolute but rather be based on continuing careful review of oil market and Federal fiscal conditions. We believe that the annual budget and appropriations process has been and will continue to be an appropriate forum for discussion and resolution of this issue.

The FY 1985 Supplemental Appropriations Act was approved on August 15, 1985. It overturned the deferral of on-budget funds for facilities development and directed

Question 9 (continued)

A: (continued)

that oil fill continue in FY 1986 at a rate that will achieve a 500 million barrel oil inventory by the end of FY 1986. Any further fill will be dependent on future budget actions, the world price of crude oil, and ongoing assessments of U.S. vulnerability to crude oil supply disruptions.

Question 10.

How does the Department's global energy model (the International Energy Evaluation System) and its assumptions about future world energy prices feed into the Department of Agriculture's world food models?

-- Is there a formal mechanism for the two department's modelers as well as policy-makers to regularly share information about supply, demand, prices, and assumptions about them?

A: The Energy Information Administration (EIA) projects energy prices, energy supply, and consumption for market economies. This information is published in the Short-Term Energy Outlook and Annual Energy Outlook. EIA no longer uses the International Energy Evaluation System. There is no formal arrangement for sharing of information between the modelers for the Department of Agriculture and the Energy Information Administration. However, the Department of Agriculture uses various Energy Information Administration publications to help make their projections. These include the Annual Energy Review, Annual Energy Outlook, Petroleum Supply Annual, Monthly Energy Review, and the Petroleum Marketing Monthly. In turn, the Energy Information Administration has occasionally attended briefings of the "Outlook" given by the Agriculture Department's Economic Research Service.

Question 11.

On April 16, the former director of the Global 2000 Report wrote the President urging him to initiate a report looking into the world's twenty-first century. He suggests an improved Global 2000 Report using the state-of-the-art improved global models now existing in government, using current data, documenting the assumptions, and avoiding many of the pitfalls and limitations of the original Report.

-- What is your reaction to this proposal to look into the global future twenty years hence?

A: In my opinion, such a study could well be interesting. However, it would not necessarily have any greater validity or importance than individual subject area studies being done by various government (and private) agencies. In fact, its usefulness and accuracy would much more likely depend on the quality and personality of those doing the studies than it would on their centralized nature or organizational location. It is thus not Administration policy to undertake such a study at this time.

Senator **Mathias**. Our next witness is Mr. Kelley White, Director of the International Economics Division of the Department of Agriculture.

TESTIMONY OF T. KELLEY WHITE, DIRECTOR, U.S. DEPARTMENT OF AGRICULTURE, INTERNATIONAL ECONOMICS DIVISION, ACCOMPANIED BY GERALD BARNEY, DEPUTY CHAIRMAN, WORLD AGRICULTURAL OUTLOOK BOARD, AND RICHARD McARDLE, REMOTE SENSING COORDINATOR, WORLD AGRICULTURAL OUTLOOK BOARD

Mr. **White**. Thank you, Mr. Chairman. It is a pleasure to have the opportunity to talk with you today.

I have with me Mr. Gerald Barney, Deputy Chairman of the World Agricultural Outlook Board, and Mr. Richard McArdle, the Remote Sensing Coordinator for the World Agricultural Outlook Board.

We have prepared a formal statement in response to the questions you submitted to the Secretary, and request that that be entered into the record.

Senator **Mathias**. Without objection, it will be a part of the record.

Mr. **White**. The Department of Agriculture has, and has had, for a considerable period of time, a relatively comprehensive and continuous program of monitoring current agricultural conditions and attempting to foresee future agricultural conditions.

The Department not only has considerable capacity, but I believe that capacity is increasing over time. Most countries of the world tend to look to the U.S. Department of Agriculture for the integrated and comprehensive view of global agriculture, both in terms of the current situation and the longer term situation.

While we have considerable capability, there are also serious limitations to the Department's foresight capability. Historically, we have focused primarily on our major competitors in the world market and our major market countries. More recently, we have had increasing involvement in attempting to project and forecast the food aid needs of the food deficit, less developed countries of the world.

The foresight capacity of the Department is housed in several agencies, each of which bring unique capabilities to our foresight program. Each brings unique forms of expertise, and each brings a unique perspective. These multiple approaches to our foresight program are coordinated and integrated by the World Agricultural Outlook Board. This has the advantage of giving us the diversity of view and expertise as input into the program, within an integrated form of coordination, so that we have a single, official set of departmental forecasts or projections. The newer foresight activities of the Department focusing on the less developed countries has grown out of the President's proclamation in observance of the 30th anniversary of Public Law 480 which led to the formation of an interagency working group chaired by the Economic Research Service of the Department of Agriculture.

This interagency working group is attempting to provide the kind of integrative forum that the World Agricultural Outlook

Board has provided for our more commercially oriented global outlook programs. It will integrate and coordinate capabilities, not only from the Department of Agriculture but from the Agency for International Development, NOAA, and a number of other agencies within the Federal Government.

Now, I would like briefly to comment on a few of the major characteristics of the Department's foresight activities, and then make a few comments about some of the more important limitations of our program.

First of all, I think it is important that we characterize the Department's foresight activities and program not as an attempt to make predictions about the future in the sense that futurists do but as an attempt to take what we have learned from historical trend analysis of agricultural and economic performance, and project that performance into the future. Those trend projections are then adjusted for either forecasted or assumed changes in factors which might cause future performance to deviate from historical trends.

Another major characteristic of our program is its very heavy dependence on foreign countries themselves for the data that we have to work with. We have as a Department and agencies within departments, very little capacity, and even less opportunity, to go into other countries for direct data collection.

In the case of the more advanced economies, we are able to depend on those governments, not only for data but also for their own forecasts.

Most of the forecasts are trend projections based. In our shortrun forecasts the factors that cause deviations from those trends, are primarily weather related. Other factors that can affect the short run deviations from trend are civil disturbances and in some cases radical policy changes on the part of governments.

In the longer term, in addition, we have general economic conditions, Government policy, and significant technological changes which bring about deviations from long-term trends.

We have three basic lengths of run that we focus upon in our global foresight activities within the Department. Our primary emphasis and most of our resources have been and continue to be focused on the relatively short term forecast, that is, the current production year and 1 year out in production.

It is in this short run forecasting that trend projection is most likely to be helpful to us. It is also in short run forecasting that continuous monitoring of crop conditions and weather conditions in the world are most critical to the continuous updating of the current and 1-year-out projections.

We also maintain and utilize internally a midterm forecasting capability which looks out 3 to 5 years into the future with respect to agricultural production and the performance of agricultural markets, including trade.

We have not historically published these midterm forecasts. Our reason for not publishing is that it is a short enough period of time that markets will react significantly to an official Government view of what might happen to production or trade within the next 3 to 5 years.

The ability to forecast the determining factors within that period of time is much less than our ability to forecast the determining factors in the 1-year time horizon, and we do not maintain the capability to continuously update the 3- to 5-year forecast. Therefore, we feel that there is significant risk that an official 3- to 5-year forecast would provide unnecessary shocks to commodities markets.

There is also a risk that since some of the driving assumptions of these midterm models are policies of U.S. Government and other governments, that there may be a tendency to take the assumptions used in making midterm projections as projections of what the administration's policy is likely to be over the next 3 to 5 years.

Third, we maintain a longer term, or a long-term forecasting and analysis capability which looks out 5 to 20 years into the future. These types of forecast or projections have been made approximately every 5 to 10 years. The Economic Research Service did produce and publish a set of projections of alternative futures for agriculture to the year 1985. This was published in 1975. At the present time we are just finishing a new study which will include projections for alternative scenarios for world agriculture to the year 2000. That report will be published during this fiscal year.

We do use models in our foresight program. We use many models and a wide variety of types of model. They vary from very specific yield and production models for individual crops to global models that are economic and policy driven with country and commodity disaggregation in them.

Now, let me say just a few words about some of the more serious limitations to our capability. Probably the most serious limitation is that of data. Data has limitations in terms of its quality, its consistency, and also its availability. Since we are dependent on foreign countries and their governments for much of the data that we have available for agriculture and economic behavior in other countries of the world, the quality varies widely and tends to be closely correlated with the degree of development of the country. From the more highly developed market economy countries we have quite good data. From the less developed countries the quality of data is much poorer.

There are consistency problems in terms of the process by which the data is collected, the units of measurement that are used for commodities, and also the year on which data is collected and published, different crop years, different market years.

We also have problems of availability and access to the data. Even those countries which make their data readily available to the United States and to other countries, there is at times the timeliness problem in that the data is not available as soon as it would be useful to have it.

In some cases reliable data simply does not exist, and in a number of cases countries produce reasonably reliable data but for one reason or another choose not to make that data available.

For example, the Soviet Union has not released any official crop production estimates for a number of years, and has severely limited the ability of U.S. representatives to travel in production areas in the country. This places a severe limitation on our ability to cross check our projections or estimates with official data. It also limits our ability to conduct research which gives us a better understanding of how the system works and therefore increases our ability in the long term to model that system.

Senator **Mathias**. Let me interrupt you to ask you, don't national technical means help you to supplement your other inadequate sources of information?

Mr. **White**. Yes. The second major limitation is our limited ability to forecast those forces which determine the behavior of agricultural production and which influence markets. These are weather, general economic conditions, and policy.

We can forecast weather for a few days, at times a few weeks into the future. Our ability to forecast weather for longer periods of time is very poor. Therefore, our projections for a crop year before the crop is started begin as trend projections assuming normal weather. We then modify those projections as weather occurs during the year and modifies the behavior of the crop.

As we all know, our ability as an economics profession to project general economic conditions is not very good in the longer term, and these are major driving forces in the behavior of agriculture and agricultural markets in the medium and longer term. We normally use other forecasts of general economic conditions, either from other agencies of the Government or from the private general economic forecasting services such as Chase Econometrics or Wharton.

Policy is also a major driving force which we have limited ability to forecast. There has been some work done to attempt to model the policymaking process, but it is very limited. Therefore, most of our longer term projections are made by assuming alternative policy environments and then estimating what the effect of alternative policies would be on the behavior of agricultural production.

There was a feeling that the development of remote sensing technology and satellites would remove many of the limitations on data that we had faired historically. I think some of those early expectations were overly optimistic. Remote sensing data is useful. It is especially useful in monitoring current crop conditions in a general way, current weather conditions, and in some cases being able to measure areas of crops by type in countries. It is especially useful in those countries with either poor data or countries which do not make their data available to us.

Unfortunately, the remote sensing technology works best in those countries in which it is least needed, that is, it is much easier to reliably interpret remote sensing data when you can establish ground truth and get the correspondence between what is being seen by the remote sensing satellite and what, in fact, exists on the ground. It also works best when you have large field size and where agricultural production is in monoculture rather than mixed crops.

Cost of remote sensing is still a factor that we have to consider, not just the cost of acquisition of the data but also the cost of processing, analysis, and storage of that data.

While timeliness can be one of the greatest advantages of remote sensing data, it can also be a disadvantage when the time required for processing and interpretation becomes a limiting factor.

There are future questions as remote sensing capabilities move from public to private sector institutions such as whether there will be limitations by copyright or other kinds of limitations on access and usability of remote sensing data.

Remote sensing is a valuable supplement to direct observation as a source of data, but it is not at this point an adequate substitute.

A final limitation on our ability for global foresight and modeling is the complexity of world agriculture and the world economy and the difficulty of modeling both agriculture and the economy. We cannot model what we do not understand. We have deficiencies in understanding, especially the behavior of the centrally planned economies of the world and to a lesser extent the less developed country economies of the world. In both cases markets are less important driving forces determining behavior, and we have less theory to guide us in understanding that behavior. We need continuing research to better understand the behavior of agriculture and agricultural economies to improve our ability to model and therefore to forecast.

For the time being our foresight and our modeling will be limited to conditional forecasts which are dependent upon the assumption that the underlying relationships don't change radically, and on either other institutions' forecasts or our own assumptions about general economic conditions, technical change, and policy decisions.

That concludes my formal comments. Thank you.

Senator MATHIAS. Thank you very much, Mr. White. It is my understanding that China has been a rice exporting nation for a number of years, but in the last year or so it has also become a grain exporting nation.

Now, just as an example, did you anticipate that?

Mr. WHITE. They have become in the last couple of years a significant exporter of course grains, feed grains. Yes, I think we anticipated that because it occurred primarily as a result of a very significant change in policy in the People's Republic of China. The new policies resulted in changes in the incentives that were provided to the producers, and changes in the relative prices of the crops that are produced. We did not anticipate the policy change but once the policy change was in effect, then it was possible for us to anticipate at least the possibility that they would become surplus producers of some crops such as feed grains.

Senator MATHIAS. What did you do with that anticipation?

Mr. WHITE. That information is published as a part of our continuing outlook process.

Senator MATHIAS. About how much lead time did you manage?

Mr. WHITE. I can't tell you when we first anticipated that they were going to become an exporter.

Mr. BARNEY. I think it has been in about the last 3 or 4 years that it has become very obvious that the termination of the so-called Cultural Revolution, the adoption of the so-called responsibility system, in China, has resulted in a fantastic increase in agricultural production. I believe since about the mid-1970's Chinese agricultural production has essentially doubled, and it has, in fact, been associated with, as Dr. White has indicated, termination of a political policy which probably we could not or would not have forecast, and the adoption of this new system. Certainly, I would say within the last 3 to 4 years we have known that the potential for China to become a competitor, at least in the short term, is there.

Senator **Mathias**. Now, if you add that development—incidentally, do you foresee that they will continue to expand their agricultural production?

Mr. **White**. I think that they will continue to expand their agricultural production. Our analysts do not think that they will be able to sustain the rates of increase in agricultural production that we have seen over the last 5 years or so since the introduction of the responsibility system in providing more incentives.

Senator **Mathias**. So you are saying it will continue to grow, but not——

Mr. **White**. Not at the same rate.

Senator **Mathias**. But if you add that development to the revolution in agriculture in India, you have a significant impact on world food supplies and on the agricultural economy, do you not?

Mr. **White**. You certainly do. I don't think that there is any question that there was a failure to adequately anticipate in the 1970's the—well, two or three things. One, we did not adequately anticipate what was going to happen to general economic conditions, and I think we probably tended to underestimate the ability of other countries of the world to increase production. But a major part of that has been a very radical change in the relative incentives available to producers in other countries of the world.

Senator **Mathias**. What utilization have we made of that information in domestic policy?

Mr. **White**. That information gets fed into the analysis we do of alternative policy scenarios. Those alternative outcomes of different kinds of policies, including our best estimates of what foreign reaction to changes in our policy would be, are made available to the policymakers within the Department.

Senator **Mathias**. Mr. Boggs says that the best thing to do is to leave it to the private sector to make the adjustments. Has the private sector made the adjustments?

Mr. **White**. It certainly has. It is undergoing some very significant adjustments——

Senator **Mathias**. 250 farm sales a day, according to the Senator from Arkansas. That would be the adjustment that you see taking place?

Mr. **White**. If we maintain the conditions in the world markets, macroeconomic conditions that currently exist, then the prices perceived by our farmers are going to be low relative to the prices perceived by farmers in competitor countries. Farmers in competitor countries will have an incentive to increase their production. Our current farm programs limit the ability of U.S. exports to compete on a price basis in world markets, and therefore domestic producers will be faced with what they will perceive as inadequate prices given the debt structure that they have accumulated, and there will be problems.

Senator **Mathias**. Well, it would seem to me that this is the kind of useful information which might—and I won't ask you for a comment on this. I will take the burden of it, but that this is the kind of useful information which might induce a government, looking ahead, to see what it could do to buffer, particularly small economic units in the private sector, who would find it very difficult to make the changes without some government leadership and some assistance.

Mr. **White**. I appreciate you taking the responsibility for that comment.

Senator **Mathias**. Well, I thought you might have some difficulty saying that. I won't even ask you whether you agree or disagree.

What about Ethiopia? How soon did you know that there was going to be a problem in Ethiopia?

Mr. **White**. We knew at least 2 years ago that there were climatic conditions in Ethiopia which, if they persisted, would result in crop failures in some parts of the country. One thing that delayed some reaction to the Ethiopian situation was that the drought was not uniform within the country. It was restricted to one part of the country. But we knew early in the crop year in which the drought began that if it persisted, there would be shortfalls of production.

Senator **Mathias**. Did you communicate that anticipation to, say, the AID officials?

Mr. **White**. Yes; we have had reasonably good working relationships at the technical level in estimation of food aid needs with AID for some time. We have, though, just in the last year, increased our emphasis in this area in the Economic Research Service.

Prior to this year, we primarily published annual assessments which, for many countries of the world, were made prior to the onset of the rains that determine the major crop. Given that Africa is in both the Northern and Southern Hemispheres, there is no way we can schedule a single annual estimate to coincide with the production season for all countries. We now are much more frequently updating those estimates. We have, under the Interagency Working Group, instituted a monthly weather briefing which brings together the resources of the Joint Weather Group and the World Board with expertise from NOAA, and is participated in by AID and other agencies to continuously update and to make sure that those kinds of information are provided more quickly to the agencies that take effect.

Senator **Mathias**. Do you achieve a consensus with AID on food needs as a result of this analysis?

Mr. **White**. We have not in the past, which is one of the reasons for the establishment of the Interagency Working Group. AID made its own assessment, and we, in Agriculture, were making an assessment, and we sometimes had the embarrassment of having two different assessments of the level of food aid needed.

We are currently working on, and I think have reached an agreement with AID and the World Board, for a process by which we will come to a consensus on the level of need.

We will also update those assessments more frequently.

Senator **Mathias**. But this would be an example of an analysis, projection, prediction—call it what you will—that requires a unique governmental response, then, would it not?

Mr. **White**. Yes.

Senator **Mathias**. There really isn't any private sector capacity for dealing with these kinds of problems?

Mr. **White**. Not really, no.

Senator **Mathias**. We are running late into the morning, and we still have two more witnesses, and as fascinating as this is, I think I am going to have to ask you the same thing that I asked the others—if you would respond in writing to some of the questions that we didn't reach.

Mr. **White**. Yes; we will be pleased to.

Senator **Mathias**. But before you leave, let me just ask you one final question here.

You note that there is a possibility of transfer of Landsat to the private sector, and that you have noted that there will be some problems connected with that. What alternate source of such data would you rely on if there was a sale of Landsat?

Mr. **White**. Well, let me ask Mr. McArdle to respond to that since he is closer to the remote sensing area than I.

Mr. **McArdle**. It is not clear as yet just exactly what course of action will be taken with regard to Landsat. It is our impression that negotiations are still in progress. We simply haven't heard any recent news on that.

Senator **Mathias**. Like Conrail, it will take some time.

Mr. **McArdle**. Yes; this is a matter between the Department of Commerce and a private firm called Eosat. So far as alternatives to Landsat data, we have no—we are not concerned that we will not be able to receive Landsat data once it transfers to the private sector. We assume that there will be contracts that will be made with the Eosat firm and that we can continue to get Landsat data.

There may be gaps coming up in the Landsat data because of leadtimes needed to develop additional Landsat satellites. Aerospace alternatives to the Landsat data would be the existing NOAA, that is, National Oceanic and Atmospheric Administration, Polar Orbiting, Environmental Satellites. We use data from those satellites now. There are also certain foreign systems that may be coming on line within the next several years.

As alternatives to aerospace data, we, of course, have a wide variety. As is noted in our testimony, we have a wide variety of ground sources, on site observations. We also do receive a high volume of weather data from ground stations all over the world through the World Meteorological Organization's World Weather Watch.

Senator **Mathias**. But as of now you really haven't got a plan for an alternate if the Landsat system is sold?

Mr. **McArdle**. If the Landsat system should go out of existence, and there is no indication at this time that it would——

Senator **Mathias**. Or be privatized.

Mr. **McArdle**. The privatization would not deny us information. We would simply have to resolve some of these conflicts or anticipated conflicts on copyright or inhibitions on use through our contracts with the firm.

Senator **Mathias**. You would have to probably pay a substantial price for it.

Mr. **McArdle**. That, again, would rely on the contracts which we would have to negotiate. There are certain indications at this time that the price from the private firm would be about that which is now charged us by NOAA.

In getting to your specific point, whether we have an alternative, our immediate alternative to remain in the aerospace remote sensing business would be to turn to the weather satellite data.

Senator MATHIAS. If they aren't privatized, too.

Mr. MCARDLE. It is my impression that a resolution of the Congress last year and a section in the NOAA appropriations bill of last year did prohibit that, sir.

Senator MATHIAS. Everything may be up for grabs after this week. So we will see.

Thank you very much, gentlemen.

Mr. WHITE. Thank you.

[Mr. White's prepared statement and responses to written questions follow:]

Statement by T. Kelley White,
Director, International Economics Division
Economic Research Service
U.S. Department of Agriculture
Before the
Senate Governmental Affairs Subcommittee on Governmental Efficiency
and the District of Columbia and the Committee on Environment and Public Works
April 30, 1985

Mr. Chairman, Members of the Subcommittee, I am pleased to be here today to discuss the global foresight capability of the U.S. Department of Agriculture (USDA). USDA officials accompanying me are: Gerald Bange, Deputy Chairman, World Agricultural Outlook Board and Richard McArdle, Remote Sensing Coordinator, World Agricultural Outlook Board.

We have prepared specific answers to the 10 issues raised in your letter to Secretary Block. These are attached to this statement. Before turning to those specific responses, I would like to provide a brief overview statement of USDA's global foresight capability and comment on its major limitations while identifying factors which will be instrumental in further expanding this capability in the future. My comments will focus primarily on the forecasting capability of USDA with respect to the rest of the world and the world agricultural economy with the United States as a component. I will not focus on USDA's capabilities specific to forecasting United States agricultural production since these capabilities are better known.

MONITORING WORLD AGRICULTURE

The USDA conducts a comprehensive and continuing program designed to monitor current world agricultural conditions and to foresee future world agricultural conditions. The Department has considerable capacity for making forecasts—this capacity is increasing—and most countries of the world look to USDA for this integrated global perspective of both current and projected world agricultural conditions. However, there are serious limitations to our ability to accurately foresee future changes in world agriculture and their implications for the U.S. agricultural economy.

Historically, USDA's forecasting activities have focused most heavily on those countries which are our major competitors and major commercial markets in world trade. More recently, USDA has become increasingly involved in the U.S. Government's efforts to estimate future food aid needs of the food-deficit less-developed countries of the world. These two efforts share many similarities of process and limitations. They differ, however, in country under focus, severity of limitations in making dependable forecasts and projections, and in the resources devoted to monitoring and forecasting.

The Department's forecasting capability is housed in several agencies, each of which brings unique capabilities, expertise and perspective to the process. The capabilities of the various agencies are coordinated and integrated by the World Agricultural Outlook Board. For the commercial trading countries, the Foreign Agriculture Service has primary responsibility for estimating and forecasting agricultural production. The Economic Research Service participates in this process through a set of interagency committees under the coordination and oversight of the World Agricultural Outlook Board. This interagency process brings together the on-the-ground perspective of the Attache Service of the Foreign Agricultural Service; the commodity analysis expertise of Foreign Agricultural Service; the country, regional and analytical strengths of the Economic Research Service; the commodity expertise of the World Agricultural Outlook Board, the Joint Agricultural Weather Facility (combining climate and weather experts from USDA and the National Oceanic and Atmospheric Administration); and modeling capabilities from all of these agencies.

SINGLE SET OF FORECASTS

The result of this integrated, coordinated process is a single set of official Departmental forecasts which draw on the strengths of the several agencies while providing internal checks and balances and preventing confusion which would be caused by multiple forecasts. The global foresight operations of USDA focusing on the commercial trading countries of the world result in forecasts of production, consumption, trade and prices for the major world traded commodities.

The foresight activities of USDA with respect to the at-risk countries historically have been less intensive, and have been restricted primarily to annual assessments of food aid needs made by the Economic Research Service with some input from the Foreign Agricultural Service and oversight review by the World Agricultural Outlook Board. The U.S. Agency for International Development has also conducted, with varying levels of intensity and coverage, assessments of food aid needs. This resulted in the sometimes embarrassing situation of having different U.S. Government estimates of food aid needs flowing from the Department of Agriculture and the Agency for International Development.

WORKING GROUP ESTABLISHED

Within the last year an interagency food aid needs working group was established by the National Security Council in response to President Reagan's proclamation in observance of the 30th Anniversary of Public Law 480. This interagency working group is chaired by the Economic Research Service and involves agencies throughout the Federal Government, including Agriculture. Its objective is to draw upon existing capabilities in the various Federal agencies to provide improved early warning capability and a coordinated process for producing a single official estimate of food aid needs. Within USDA, in addition to the Economic Research Service, the Foreign Agricultural Service, the Office of International Cooperation and Development, and the World Agricultural Outlook Board are Departmental participants in the interagency working group.

Other participants include the Agency for International Development, Departments of State, Transportation, Treasury, Office of Management and Budget, and the National Security Council. This interagency process brings together the modeling and analytical strengths of the Economic Research Service, the weather data and weather/yield modeling capabilities of the National Oceanic and Atmospheric Administration and the World Agricultural Outlook Board, the commodity and remote sensing capabilities as well as the in-country presence of the Foreign Agriculture Service, and the in-country presence and food aid delivery monitoring resources of the Agency for International Development.

GLOBAL FORESIGHT ACTIVITIES

USDA's global foresight activities are varied but have a set of common characteristics. An understanding of these characteristics helps to evaluate the usefulness of the activities. USDA's global foresight efforts are not an attempt to predict the future in the sense that futurists make predictions. Instead, they are an attempt to take what has been learned through observation and analysis of historical behavior of production and market systems under various general economic, policy, and weather conditions, and project this behavior into the future under assumed or forecast economic, policy, and weather conditions. Thus, forecasts of world agricultural conditions are conditional forecasts and whether they prove to be accurate forecasts depends upon whether the assumed underlying conditions do in fact become a reality.

The Department's global foresight programs are heavily dependent on foreign countries themselves for current and historical data; and in many cases for forecasts and projections, especially for current crop production. This dependency will probably persist so long as we require on-site observation for data collection since the United States has very limited capability or opportunity to conduct direct data collection activities in other countries. Most of the developed competitor and market countries with which the United States is concerned have highly developed indigenous data collection and analysis capabilities, and provide useful input into the Department's activities. The agricultural attache service of the Foreign Agricultural Service, with in-country presence in most of the more agriculturally important countries, provides a direct link to the in-country capabilities and is an essential component of USDA's foresight capability.

Most forecasts are based on projections of historical trends and evaluation of probable effects of selected variables that would be expected to cause deviations from trend. Most large, short-run—one year to the next, or within crop production year—deviations result from weather. Weather cannot be forecast with accuracy very far into the future. Therefore, production forecasts made prior to the beginning of a crop year are basically trend projections assuming normal weather. These projections are then modified during the year as weather affects growing conditions and the impact can be estimated. Illustrations of other factors that may cause significant short-term deviations from trend production are policy changes within individual countries and civil disturbances.

Longer-term deviations from trend may be caused by changes in general world economic conditions such as economic growth rates, interest rates, and exchange rates. Other factors causing long-term deviations are domestic and trade policy and major technological innovations. Longer-term forecasts then are dependent not only on continuation of economic and production relationships as embodied in historical trend analysis, but also upon the validity of assumptions or exogenous forecasts made concerning the future general economic conditions, the policy environment, and the occurrence of major technological changes.

The greatest emphasis in USDA's foresight program, especially in terms of published forecasts, is on the relatively short-term view of 1-2 years. These short-term forecasts are updated periodically and can, therefore, be adjusted to take account of changing weather conditions. It is in these short-term forecasts that continuous monitoring of weather, crop conditions, and economic conditions in the world is most crucial to accurate forecasts of world production, and consequently, trade and prices.

LONGER-TERM FORECASTING

The Department also conducts longer-term forecasting activities. An intermediate-term projection—3-5 years for example—of world production, consumption, trade, and prices is conducted and maintained for internal policy analysis use. These projections are used as a basis for evaluating the longer-term effects of policy changes and general world economic trends. They are used primarily for internal analysis of alternative scenarios which are fed into the Department's policymaking and evaluation process. These medium-term forecasts or projections have historically not been published because of the tendency to look upon them as predictions and draw unwarranted conclusions. Such medium-term projections could be quite valuable to agricultural producers and agri-industry decisionmakers in making longer-term investment and production decisions. However, it is essential that the nature of such projections be understood and that they not be misused, especially as forecast of future Departmental policy directions.

STUDY NEAR COMPLETION

Periodically, the Department makes and publishes long-term projections of of 5 to 20 years world production, consumption and trade. The Economic Research Service published in 1975 a set of alternative projections of world agriculture to 1985. The Economic Research Service is completing a study which includes projections of world production, consumption, trade and prices to the year 2000. This study will be published during the current fiscal year. These long-term projections are looked upon as a useful tool for assessing long-term food prospects for the less developed countries and trade prospects for the U.S. and other exporter countries. Such projections cover a sufficiently long time horizon that variables such as population growth rate, depletion of nonrenewable resources, and economic growth rates become important variables in determining world agricultural supply, demand and trade behavior.

The agencies of the USDA involved in global foresight activities possess and utilize a wide variety of models. They range from short-term, commodity specific models for a single country to long-term world trade models with commodity and regional dissegregation. They also range from technical production models for single commodities driven by trend and weather, to economic models wherein general economic conditions and policy drive supply and demand conditions, providing projections of production, consumption, trade and price. This variety of models has been developed to meet the range of needs confronted by the various agencies of the Department in its internal policy analysis and its public outlook responsibilities. Modeling capability within the Department continues to expand as research increases our understanding of agricultural and economic systems and their behavior and as computer technology increases our ability to model complicated systems and handle large quantities of data and calculations quickly and economically.

FORESIGHT CAPABILITY LIMITATIONS

While the Department has significant global foresight capability, several factors limit our ability in this area. The extent to which these factors can be modified will determine whether our foresight capability will be improved. The quality, consistency and availability of data from the many countries of the world are serious limitations. As was pointed out earlier, the Department is very heavily dependent upon the countries themselves for current and historical data.

The quality of data available is highly variable, and tends to be directly correlated with the stage of development of the countries. Most of the less developed countries of the world have very limited capacity to collect and analyze data on agricultural production and general economic activity. To the extent that data are available on the less developed countries, their quality is highly variable and often very marginal. Less developed and centrally planned countries also vary in their willingness to make data available on their agricultural production. Much of the Department's access to less developed country data comes either through international organizations such as the U.N. Food and Agriculture Organization, the Agency for International Development, agricultural attaches in those countries where they are stationed, and/or direct contact of USDA personnel through visits.

The centrally planned economies have the capability to produce data far superior to the less developed countries, and in most cases do produce and maintain data of reasonably good quality. The principal problem confronting the Department is the varying degree to which these countries are willing to release data to the rest of the world.

For example, the Soviet Union has not released official crop production estimates for several years and severely limits access of USDA representatives to production regions for direct observation. This severely limits our ability to research and analyze the behavior of agricultural and economic systems in the centrally planned countries and, therefore, our ability to model this behavior. Limitations such as these also make it difficult to verify USDA estimates and forecasts of centrally planned country production since we have no official data with which to make comparisons.

FREELY AVAILABLE DATA

Most of the developed market economy countries maintain excellent data and freely make it available to the United States and the rest of the world. These are also the same countries which have the greatest capacity for making internal forecasts which are normally available for use by the USDA.

Inconsistency of data among countries is an additional problem. The processes by which data are collected and processed vary widely. Units of measurement are different as are the definitions of years for which data are reported. These inconsistencies make international comparisons, global modeling and global forecasting more difficult. Another important constraint is our limited ability to forecast those forces that determine agricultural production and which influence agricultural markets.

WEATHER CONDITIONS

One of the more important of these exogenous factors, especially in the short-run, is weather. Weather cannot be forecast with accuracy for more than a few days or weeks into the future. Since most large deviations from trend in agricultural production are weather related, it is essentially impossible to forecast these large weather-caused deviations in production until the weather condition setting them in motion has occurred. That is, we cannot forecast the occurrence of drought which may result in severe production decreases and, therefore, in famine conditions in a less-developed country. The best that we are able to do is to continuously monitor weather conditions and assess the probable impact of weather as it occurs on production.

For longer-term agricultural forecasting, general economic conditions are a major determining factor. As we are all aware, general economic forecasting is not a very exact science. The Department's agricultural foresight processes depend, for general economic forecasts, largely on other agencies of the Federal Government, such as Treasury, Commerce, the Federal Reserve, and the Council of Economic Advisors, and private sector institutions, such as Chase Econometrics, Wharton and Project Link.

Another important factor in long term projections or forecasts is the state of domestic and trade policy in the world. Anticipating future policy decisions by Governments is difficult. Therefore, we normally resort to modeling with alternative assumptions about the policy environment and evaluate the effects that different policy environments would have on the probable behavior of world agriculture and agricultural markets.

REMOTE SENSING TECHNOLOGY

Satellites and remote sensing technology have been seen by many as a way of improving our ability to monitor conditions and collect data on agricultural production, especially in those countries which have limited indigenous capability or which do not provide us with access to their data or allow on-the-ground reconnaissance. These technologies are improving but are still limited in their ability to substitute for direct observation. They are useful for monitoring current weather and crop conditions, and in some cases, for estimating area under cultivation in particular types of crops.

Unfortunately, these techniques work best where they are least needed. That is, remote sensing data is most reliably interpreted when there is access to ground truth so that the remote sensing data can be correlated with actual conditions. Remote sensing technology also performs best where agricultural production is characterized by monoculture in large plots. At this time, remote sensing is a useful supplement to other sources of information but is not an adequate substitute. The high-technology aura surrounding remotely sensed data from space sensors tends to obscure the essential fact that aerospace remote sensing is simply one of many sources of information available to the decisionmaker and, in this total context, must be evaluated and compared with other sources of information. Cost factors, not only the cost of the data but the handling, processing, analysis, and storage, become critical. Another critical element is timeliness. If remotely sensed data are not available to the decisionmaker when needed for a crop forecast, their utility is degraded, and the primary use is that of confirmation. Still another factor that must be considered in evaluating aerospace remotely sensed data, and especially with the proposed transfer of the U.S. civil land-observing s system-LANDSAT—to the private sector, is whether usage will be inhibited due to copyrights or other restrictions. Soon-to-be-launched foreign systems pose similar questions, including ready and non-discriminatory access to data.

World agriculture and the world agricultural economy are tremendously complex and therefore difficult to model realistically. Our ability to model depends upon our understanding of forces and relationships. Much additional research is needed to provide adequate understanding of agriculture and agricultural economies as a basis for realistic modeling. This is especially true for the less developed economies of the world and for the centrally planned economies which are not dependent upon market forces. Since the world is complex, modelers must always make trade-offs between country and commodity detail and the ability to construct an operational model which is understandable, maintainable and which can be solved in short enough time to provide useful input to the policy process. All of our large scale models, at present, depend primarily on the exogenous definition of the policy environment. We have made only very limited progress in understanding and modeling the policymaking process. Until we are able to do a more realistic job of modeling and forecasting, general economic behavior and the policy making process our models will be limited, in the forecasting process, to providing information about the probable behavior of agriculture and agricultural markets under assumed general economic and policy conditions.

To respond to the specific questions you raised in your letter to Secretary of Agriculture John R. Block following are answers to the ten specific issues that were identified. If you wish, I shall submit them for the record and answer any other questions you may have.

RANGE OF FORECASTS

Question. Please provide a description of what types of forecasting the Department performs, its range, and the information and data upon which such forecasts are based.

Answer. The Department's situation and outlook program has a short-term focus which looks about 1 year into the future. Worldwide supply and demand estimates for the principal agricultural commodities which move in international trade are issued by the USDA in a monthly summary report entitled World Agricultural Supply and Demand Estimates. This report focuses on wheat, rice, feed grains, soybeans, cotton, and dairy, livestock, and poultry commodities and shows country detail and regional aggregates for the most significant producers and traders. This publication is followed by a series of in-depth reports by the Economic Research Service and the Foreign Agricultural Service.

USDA also publishes short-term forecasts for a number of "specialty" crops, including sugar, coffee, cocoa, certain fruits and vegetables, and numerous other commodities. These assessments are issued periodically during the year, usually quarterly or semiannually.

Official USDA forecasts are the end product of a rigorous interagency process coordinated by the World Agricultural Outlook Board which brings together multiple disciplines. Global supply/utilization assessments are based on a wide variety of information sources which may include attache reports, trade contacts, field travel, official foreign data, and a variety of meteorological and remote sensing inputs. Short term crop condition assessments incorporate meteorological developments up to the date of the forecast. To avoid making excessively high or low estimates, USDA analysts assume that "normal" meteorological conditions will prevail for the remainder of the crop season. As the growing season progresses, forecasts are continually adjusted to reflect the latest information.

In addition to short-term forecasts, USDA also produces commodity forecasts which focus on the intermediate term. These analyses, which span the next 5 years, are used primarily to estimate domestic farm program costs and evaluate policy alternatives. Commodity outlook assessments are extremely sensitive to the underlying analytical assumptions with respect to domestic and foreign policies as well as the unpredictable vagaries of weather. Thus, to avoid sending commodity markets potentially misleading signals, these forecasts generally are not published.

The Economic Research Service conducts and publishes a substantial amount of research which focuses on the long term outlook, generally a 5-15 year time horizon. While these assessments are useful for planning purposes they must be used with caution given the uncertainties of long-term forecasting. Nevertheless, these projections have proven to be useful in anticipating major structural shifts within global agriculture. This work has provided particular foresight in identifying potential food surplus and deficit areas well in advance.

DECISION TOOLS

Question. Discuss the decision tools which Department policymakers use in addressing national and international issues on supply, demand, and competition for food and fiber.

Answer. Decisionmakers within the Department have a vast array of "tools" which they can call on to address national and international supply and demand issues. These tools range from very complex formal international models to the specialized knowledge and expertise of analysts responsible for a specific country, commodity, or subject. Which tool or collection of tools is used to address a specific issue depends on the scope and complexity of the issue, the timeframe of the analysis, how quickly the analysis is needed, and the adaptability of the model.

The mainstay of the Department's ongoing short-run work on domestic and international supply and demand conditions is the knowledge and experience of the staff in the various agencies of USDA. The coordination of information rests with the various interagency committees. They provide a forum for assembling, analyzing, and projecting from the information provided by analysts of the various agencies. Information collected for the United States and many foreign countries include: economic and financial conditions, weather, internal and trade related policies, disease outbreaks, transportation problems, famines, and many other social, technical, and political factors. The information, and related analyses of potential impacts, are provided to the Department's decisionmakers and disseminated to the general public via various Department publications.

Many of the analysts use commodity or country specific models, and have available the results of more complex cross-commodity models, in developing their shortrun forecasts.

The more complex formal models have their widest usage in analyzing issues involving several commodities or countries, or a specific issue over an extended period of time. These formal models exhibit a broad range of coverage and complexity--some are commodity or country specific, while others are models of the U.S. agriculture, and a few are models of world agriculture. These formal models are used not only to provide estimates of supply, use, and trade for the world and/or the United States, but also to estimate the impacts of various policies on land and water utilization, food prices, farm income, and other economic and social conditions.

UDSA's decisionmakers have access to more than the complex models developed in the Department. They can draw on results of several of the well known private forecasting models--general economic or agricultural models for the United States and world macroeconomic models.

The numerous analyses of the various proposals for the new farm bill are examples of how the Department's decisionmakers have utilized most of the formal and informal tools. Country and commodity expertise from the various analysts in the Department have been used in conjunction with results from the more formal models.

CURRENT DATA NEEDS

Question. Please discuss the Department's current data needs with respect to high priority agricultural and other renewable resources type information.

Answer. USDA attempts to assess global prospects for economic growth and development and for agricultural production, and to estimate the demand for agricultural commodities. To more adequately address these issues, USDA is attempting to develop and maintain an inventory of the world's land resource base. Data to measure the physical resources and constraints to agricultural production is needed for this purpose. The U.N. Food and Agriculture Organization currently makes estimates of land area by broad use categories--irrigated, arable, and permanent cropland; permanent pasture; forest and woodlands; and other lands. Data are needed to establish the potential availability of these land categories, given the current state of technology and physical constraints to transforming each country's land resources into higher-use categories through investment.

There is a need for better quality data on the availability and utilization of water resources. Distribution of rainfall and development of irrigation projects are key production variables.

USDA also needs to develop an international data base on the availability and use of purchased inputs by commodity and per unit of land to better assess both the constraints to and potential for increasing agricultural productivity. For example, data on the use of fertilizer and machinery per hectare of cotton (and other crops) are essential to accurately assess world-wide production potentials.

The availability of resources is very important, but equally important is how resources are converted to agricultural products and services. Data on the input-to-output relationships are not readily available. The information which is available is not of a quality which permits comparability across countries. These technical data are essential if the USDA is expected to provide policymakers with comparative cost of production information and competitive advantage comparisons.

The concept of comparative economic advantage can be used to estimate optimal allocation of both national and global agricultural resources. However, more complete time series data are needed on domestic and trade—both c.i.f. and f.o.b.—prices; transportation and marketing margins from a country's borders to internal points of production and consumption; taxes and subsidies on specific commodities; producer and consumer price series reflecting internal transportation differentials; and estimates of the import component of inputs and final consumer goods. If this information were available, USDA could better analyze and projected the role of agriculture within developing economies and evaluate comparative advantage among competing countries.

AgRISTARS

Question. Please provide a description of the AgRISTARS program and its use by department policymakers.

Answer. AgRISTARS—Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing—is a research program designed to test the usefulness of data collected by satellites and other space sensors in USDA's information systems. The AgRISTARS research program includes not only agencies within USDA, such as the Agricultural Research Service and the Statistical Reporting Service, but also the National Aeronautics and Space Administration, the Department of the Interior, and the National Oceanic and Atmospheric Administration of the Department of Commerce. Original plans called for AgRISTARS to run from fiscal year 1980 through fiscal year 1985—a total of six years. Budget constraints and redirection of resources have left only two active participants at the present time: USDA and Commerce. As of this date, the program is still officially in existence. None of the partners has formally withdrawn and the term of the program will be completed as originally planned.

Remotely sensed data are but one of the many sources of information available to and used by USDA policy officials and program managers in making decisions. The AgRISTARS program has demonstrated that there are many technically feasible applications of data acquired from space platforms in agriculture, renewable resources, and the environment.

Within USDA, and drawing upon applications developed in AgRISTARS, remotely sensed data from Landsat land-observing satellites and from polar-orbiting environmental—meteorological—satellites are being used as a source of information to improve acreage statistics of selected crops in the midwestern U.S. and to locate, delineate, and monitor crop conditions in major foreign agricultural regions. Aerospace remotely sensed data are at the present time an adjunct source of data in qualitative crop assessment, but assume greater significance for those countries where access is denied or where agricultural reporting systems are not fully developed.

AgRISTARS has provided a focal point within USDA for research on application of aerospace data. More important perhaps, the AgRISTARS program has provided a common ground for Federal departments and agencies to meet, to share, and to pool their respective expertise and talents. That data from space platforms, from satellites, space stations, or spacelabs, have great potential as a source of information for crop assessment.

EARLY WARNING SYSTEM

Question. How is the department's global early warning system and crop condition assessment carried out; also please discuss the timeliness and reliability of data upon which those programs rely.

Answer. The Foreign Agricultural Service maintains a worldwide agricultural intelligence and reporting system through its attache service. The attache service consists of a team of roughly 100 U.S. professional agriculturalists posted at about 70 American embassies around the world. The attaches' areas of responsibility encompass more than 100 countries. The attaches form the nucleus of a global reporting system that includes continuous reporting on world crop production levels and assessments of factors that affect crop production such as weather conditions, technology and policy.

In Washington, Foreign Agricultural Service commodity analysts through the use of a high-speed and sophisticated telecommunications/computer network analyze the attache reports and combine them with additional background information that is provided by the Foreign Crop Condition Assessment Division. This division can provide commodity analysts with timely information on the existence, severity, extent, and probable impact of weather-related events on foreign crop production. It has the resources to use advanced analytical methods, remote sensing information, and modern data processing technology to analyze foreign crop conditions. Types of models employed include soil moisture, crop calendar, winterkill, heat desiccation, and crop stress models.

Variability in weather and other crop related variables give rise to severe crop shortfalls and creates food emergency situations. The Department has responded to these situation by actively participating in food aid needs assessments. Recent severe food crises in the African countries have stimulated new initiatives geared at more accurately predicting potential food aid crises.

With respect to our present capabilities, the early warning and crop assessment activities of the USDA have been developed in response to the P.L. 480 requirement for an annual global food assessment and to ensure the judicious use of U.S. Government stocks of agricultural commodities. This requirement has necessitated the establishment of data systems and a core of country and commodity specialists charged with the responsibility of staying abreast of agricultural and economic events in food aid recipient countries. These analysts continuously monitor all sources of agricultural and economic information on these countries; national agencies, U.S. agencies, and international organizations. Data files are regularly updated and employed to make projections of near-term crop expectations and estimated aid needs.

The accuracy of data upon which current crop conditions and food aid needs assessments are based varies widely from country to country. As you might suspect, large numbers of data problems arise in the developing countries, and especially in the current food crises countries. The agricultural and statistical reporting capabilities are so limited that our country analysts are frequently forced to adjust "officially" reported information to derive results consistent with historical information. A few of these data problems can be lessened by a coordinated interagency effort within U.S. government agencies. However, most data problems are beyond our immediate control and will continue to be problems for many years to come.

New initiatives have been taken to improve U.S. Government food aid needs assessments. On the 30th anniversary of the P.L. 480 Food for Peace Program, the President announced a major five-point emergency food aid initiative designed to reduce human suffering and loss of lives brought about by acute food shortages in the Third World. That initiative, an outgrowth of the Presidents' Emergency Food Aid Task Force, mandated an interagency working group led by USDA's Economic Research Service to further develop information to better anticipate the magnitude, frequency, and location of Third World emergency food needs and better structure the U.S. response. This Interagency Food Aid Analysis Working Group will coordinate the needs assessment work of the U.S. agencies, and cooperation with relevant international organizations, and private voluntary organizations.

The objectives of the Working Group are: to develop better data and improved methods to assure timely and objective assessments of chronic and emergency food aid needs, and for evaluating the impacts of food aid programs, and to coordinate data gathering and analysis among U.S. agencies, and to interface with international agencies to analyze the impact of food aid on economic development, financial aid, foreign trade, and domestic agricultural policies of recipient countries

Although the Interagency Working Group is not yet a year old, and formal agency and staff working relationships are still evolving, it is clear that more objective and timely crop and food aid needs estimates will flow from the efforts of this Working Group. This progress has been made possible by the coordination of the substantial capabilities within agencies. Improved early warning and assessment did not require additional resources, but rather the integration of existing units in pursuit of a common goal. For example, within USDA, the Agency for International Development, and the Department of

State improved lines of communication have been achieved, and a start made on standardization of data reporting. Another achievement is improved dissemination of reporting on weather, food crop conditions, and emergency situations.

FOOD PRICES

Question. What assumptions are made with respect to food prices' annual change between now and 1990, and the year 2000. Describe how those assumptions are translated into farm price support legislation.

Answer. Food prices are only one of many economic effects that Department decisionmakers consider when assessing potential farm legislation. The Department also analyzes alternative policy options, including levels of price supports, to determine their impacts on production, consumption, farm income, trade and other economic indicators. Analysis of policy options involves determining how changing farm prices for crops directly affect food prices, as well as how they affect livestock production and prices.

Food prices, being determined by the equilibrating of demand and supply in a world setting, are one of the most important variables underlying economic policy and projections analyses. Levels and the potential changes in the U.S. and world prices are an important result of any creditable policy analysis or projection of economic conditions. Other key economic change variables which are frequently monitored include production, consumption, trade, stocks, and input costs.

Farm price support legislation is one policy instrument used by Governments in many countries, including the United States, to achieve politically desired goals such as minimum farm income levels. Minimum support prices set greatly above free-market clearing levels represent market distortions which affect resource allocations and product distributions. They must be taken into consideration in projecting future demand and supply conditions. When support prices are institutionally set above market clearing levels, they cease to function to equate demand and supply and lose their significance as an economic change indicator. When this happens, other change indicators such as expected production, consumption, stocks levels, and exports/imports take on added significance. This is demonstrated by current U.S. commodity support prices in the form of target and loan rates. They have been set sufficiently above market clearing levels in recent years. The result is that they have provided economic incentives to producers to expand production of price supported commodities to a level far exceeding domestic consumption and exports. Consequently, stocks have increased to burdensome levels.

The United States is a very large international supplier of agricultural products. World prices for several commodities have been basically established by the price setting policies of the United States. World prices distorted by the price supporting policies of major producing and trading countries tend to depress consumption worldwide while providing producers an economic incentive to expand production. The end result is often a declining trade share. For this reason, projections of production, consumption, trade, stocks, and food prices made for any future year—such as 1990, 2000—must take into account expected price distortions resulting from farm price support policies of important producing and trading countries.

A recent analysis of world agricultural supply, demand and trade prospects in the year 2000 was recently made by the Economic Research Service. In this study, real food prices were internally determined in the analytical procedure by considering alternative growth patterns in demand and supply determinates, that is, income, population, production technologies, domestic and trade policies.

GLOBAL MODELS

Question. How are global models used in making forecasts of crop yields, forest production, and rangeland sizes.

Answer. The Department uses a variety of methods to forecast U.S. crop production. These include probability and nonprobability surveys, statistical or econometric models, mathematical models, and expert judgment.

Monthly surveys are used to forecast the current year's expected yield and production during the course of the growing season. Questionnaires are mailed to about 55,000 crop reporters, with additional questionnaires sent to known producers in certain areas. In addition, enumerators make objective yield counts for 1,600 to 2,500 samples, depending on the crop. These surveys are conducted, compiled, and analyzed by the Department's Statistical Reporting Service, and the forecasts are published monthly in the report Crop Production.

Forecasts are also made for the current year before the SRS surveys are conducted, and forecasts are made for future years for which survey data are not available. These forecasts are based on quantitative models and judgments. Quantitative models are both large and small scale. Small-scale models are those used by analysts to assess narrowly defined geographic regions or specific crops or classes of crops. Large-scale models examine the United States and account for acreage, yield, and demand for numerous crops. Such models allow for the interaction of one crop market with another.

Two large-scale models which provide production forecasts are the Economic Research Service's Quarterly Forecasting Model and Food and Agricultural Policy Simulator. These formal models forecast acreage planted, acreage harvested, and yield per acre. Acreage planted is forecast on the basis of previous planting patterns, expected returns on crops, and Government crop programs expected to be in place. Acreage harvested is forecast on the basis of acreage planted and the historical relationship between planted and harvested acreage. Yield forecasts are based on past trends in productivity, expected prices of crops and production inputs, weather, and acreage. Forecast production is then the product of forecast acreage harvested and forecast yield per acre. Because the two models represent the complete market, they forecast demand and prices. The price forecasts are used to determine the expected prices on which the acreage and yield forecasts are based. The quarterly model contains about 150 equations, forecasts quarterly data, and is normally used to forecast up to two years into the future. The simulator model contains around 400 equations, forecasts annual data, and is normally used to forecast up to 10 years into the future.

For very long-run projections, the Economic Research Service utilizes the National Interregional AGricultural Projections (NIRAP) system. This model is designed to project from 5-50 years into the future. The model is very large, projecting production for 31 commodities on a state level. The model projects crop yields based on trends and total production based on projected use. Acreage is determined by apportioning production to regions according to historical production shares, then acreage is computed based on regional yields. Irrigated and nonirrigated acreages are projected. The very long-run nature of the model (for example, it does not consider specific Government programs for crops) makes its most suitable for assessing events which may take time to develop, such as environmental issues like water availability and soil erosion.

Most of the small-scale models, which focus on specific crop acreage or on yields, are based on trends and economic variables such as expected crop prices and production costs. Some yield models for short-run forecasting contain weather data, such as average monthly rainfall, temperature and soil moisture. In addition, some contain levels of inputs used, such as nitrogen or pesticides.

Forecasting with the above-mentioned models requires strong statistical relationships between acreage and yield and their explanatory factors such as trends, weather, and expected returns. The quality of these relationships varies by crop and by region but tend to be better the more important the crop and the more aggregate the region. Forecasting also requires a wide variety of good quality data—for both acreage and yield and their explanatory factors. Such data come from many sources, such as many Federal Government agencies, State governments, foreign countries, international organizations, and commodity and trade associations. Quality of data affects quality of forecasts. Most data used come from public information data bases developed by governments. Data of questionable quality are generally not used in the model development or used for forecasting with formal model techniques. Most official Departmental forecasts combine a variety of model forecasts with expert judgment.

CANADA AND LATIN AMERICAN COUNTRIES

Forecasts of crop areas planted and harvested, yields, and crop and livestock production for the current agricultural marketing year are informally determined through a Delphi-like process of expert decision-making. Agricultural attaches located in the countries provide initial estimates based on observation and communication with country officials, and industry and trade representatives. Initial estimates subsequently are examined, discussed, and revised by commodity analysts in the Foreign Agriculture Service and Economic Research Service, country analysts in ERS, and World Board members.

The multi-year forecasting process involves formal computer modeling, the results of which are tempered by informal, expert judgment regarding the ways in which variables excluded from formal models are likely to affect future land use and yield trends.

Supply response to project price levels and changes in domestic demand is forecast, subject to resource base constraints, crop rotation requirements, cyclical livestock production patterns, and productivity growth. Linkages between key variables, such as feed availability and livestock production, are maintained. Supply-demand balance sheets are then produced, with exports determined largely as a residual. Projections are made for up to 10 years.

Formal forecasting models are available for Canada, Brazil, Argentina, Mexico, and "Other Latin America." These computerized models perform trend analyses. Trends in production and demand of major grain and oilseed crops, and in livestock volume, are estimated using historical data. The trend is projected into the future, but its rate of change is modified on the basis of current data on population and income growth rate data, current and projected world commodity prices, price transmission coefficients, and price and income elasticities. Trends are projected for up to 10 years.

Historical crop areas, yields, and crop and livestock production for Latin American countries, and commodity price series are official USDA data. Population growth rates used in the formal modeling process are mostly those determined by the Bureau of the Census for Latin American countries. Latin American income figures are selected from among various sources, such as the World Bank, the Inter-American Development Bank, and publications originating in countries. Commercial data sets, such as those from Wharton and Chase Econometrics, are used, when available, as sources for cross-checking and determining relevant ranges for model variables. Official Statistics for Canada are used in conjunction with USDA and other data sources for making Canadian projections. Price transmission coefficients—which describe the extent to which world commodity prices affect countries' internal prices—and elasticity estimates—which describe the proportionate response of commodities' production to changes in price and income—are pulled from independent studies conducted in USDA and elsewhere. These data are considered the best available. But, there is uncertainty surrounding the reliability of many descriptive statistics.

Because the formal forecasting models do not contain data on how weather conditions, macroeconomic variables, or political events affect agricultural production, model results are reinterpreted in light of these additional, external factors. Analysts familiar with the countries examine and modify trends consistent with their knowledge of external situations

In addition, an econometric model of supply and demand for Canadian grains and oilseeds (wheat, barley and rapeseed) is available for in-house analysis.

Relationships are established for domestic demands, carryover stocks, and production. The model focuses primarily on the role of prices in determining domestic demand, supply and exports. Using exogenous forecasts of price and other variables, the model can be used to forecast area, production, domestic utilization and exports. This model has also been used to estimate production and export response to policy changes.

WESTERN EUROPEAN COUNTRIES

Most West European countries do a creditable job of making their own forecasts of crop and livestock production and these forecasts are used extensively by USDA in our own forecast work.

The first forecasts by the Europeans for the next crop are generally made in late spring. Economic Research Service analysts make area, yield, and production forecasts as much as 6 months prior to the release of the first forecasts made by the Europeans. Early Economic Research Service yield forecasts are based on trend line projections. In early spring the trend line projections are adjusted for weather conditions. In recent years forecasts have also been modified to account for the adoption of high yielding varieties. Economic Research Service forecasts of area planted use reported area planted to winter crops and forecasts for spring crops based on relative crop prices and changes in agricultural policy—particularly in the case of the European Community.

Once forecasts from the Europeans become available in late spring or early summer they are either accepted by Economic Research Service or are the base from which adjustments are made. These adjusted estimates are presented for consideration by the Department's Interagency Committees.

AFRICAN COUNTRIES

Forecasting models for the Africa-Middle East Region draws on three basic types of models:—(1) forecasting models based on spreadsheet analysis and informal country models; (2) An econometric model for South Africa (wheat and corn); and (3) An econometric model for forecasting longer-term food aid needs.

Spreadsheet models are country-specific, combining historical data and basic analytic relationships with the informal judgment of country specialists. Spreadsheets have three basic formats: supply and utilization tables for the major grains for all countries, macroeconomic variables, and trade, including supplier information for major grains.

While models differ from country to country, they are basically trend projections, coupled with informal assessments of the impact of weather. In some countries, price responses have been included on an exploratory basis. In other countries, knowledge of policies and institutional performance may be included, but through the informal models of country specialists. In a few countries where reliable information is very hard to obtain, early trade patterns may be used in conjunction with weather information to forecast production.

The time series is from 1966 to 1983. Data come from a variety of sources, including USDA Attache Reports, country reporting, the UN trade system, weather monitoring units in both USDA and NOAA, and where appropriate, FAO, and the World Bank and IMF (primarily for macroeconomic data).

The quality of data for much of Subsaharan Africa is variable, reflecting in many cases institutional weaknesses in data collection within the countries themselves. Data for selected North African and Middle Eastern countries are better.

BES OPY AVAILABLE

A simple econometric model was developed to analyze supply, demand, and exports of wheat and corn in South Africa. Harvested area is a function of the crop price, the price of competing crops, total cropland, and world price. Yield is a function of a time trend, weather index, and the ratio of crop prices to fertilizer price.

Data for South Africa come from USDA *Attache Reports* and country reporting. Fifteen years of data were used to estimate the model. South African data are of higher quality than those for most Subsaharan African countries and provides a good basis for analysis.

In connection with efforts to forecast long-term food aid needs, a simple economic model was developed for eleven countries in Subsaharan Africa. Area harvested is a function of price, lagged yield, a time trend, and a dummy variable for drought. Marketed supply is a function of price, a time trend, and a dummy variable for weather.

Fifteen years of data were used to estimate the models. Most of the countries covered are food deficit countries with relatively weak internal data collection systems, and limited coverage through USDA reporting channels. As such, data from these sources, coupled with information from previous studies and field reporting, were used. However, in many cases, data are weak. Zimbabwe and Kenya are the major exceptions to this generalization.

ASIAN COUNTRIES

Economic Research Service analysts regularly prepares forecasts of area, yield, production, consumption, and trade for major crops of interest to U.S. agriculture. We are not presently forecasting either forest product production or rangeland size.

Projection activity for Asian countries covers two distinct time periods--1-2 year forecasts and intermediate-term projections of 5-10 years. The short-term projection work is the core of the situation and outlook function. Projections of production and trade are largely judgmental and draw on a wide variety of sources--the intermediate-term projections (see below), analysis of previous trends, reporting from country publications, weather analysis provided by the World Board and other sources, and attache reporting. The mix between these sources varies widely by country.

While analysts have econometric models for intermediate-term forecasts of production and trade for certain commodities in some countries--currently Japan and Taiwan--the main intermediate-term projection tool is a series of separate baseline models for major countries in the region. These are primarily trend models which are maintained and run on microcomputers. The models cover wheat, rice, coarse grains, cotton, major oilseeds, and, where appropriate, livestock and livestock product production.

The models project forward for 5 and 10 year periods. Because of this intermediate-term focus, weather is not a variable--average weather conditions are assumed. Their major focus is trade. Projections of area, yield, and production are generated from judgments or estimates based on time trend analysis or the results of other models or studies. Consumption of individual commodities is projected using either time trend analysis or projections of population and income growth together with relevent income elasticities of demand and, for coarse grains and oilseeds, projections of feed use from the livestock subsector models. For some countries the models also contain projections of stock levels based on initial stocks and knowledge of national stock policies. Projected net trade is then calculated as the difference between the projections of domestic supply and utilization.

For those countries where price is judged to be an important variable, the models also incorporate analysts' judgments about price elasticities of import demand and export supply. The models are then used to evaluate the impact of alternative assumptions about future world market prices on domestic consumption and trade.

These models provide a formal and flexible framework for combining estimated parameters, the research of other economists, and the judgment of individual country analysts. The mix among these varies considerably between countries, depending on the quality of data.

USSR AND EASTERN EUROPEAN COUNTRIES

Economic Research Service analysts are required to provide the World Board and Foreign Agriculture Service analysts with forecasts of individual grains and oilseeds, cotton, sugarbeets, and potatoes. The Economic Research Service crop production forecasts for Eastern Europe and the USSR for both the short and long term begin with time trend analyses of yields and area. Normal weather patterns are assumed. The normal-weather trend forecasts are modified where evolving economic, political, and technologic factors are expected to affect the trend lines.

Annual forecasts are revised as information on sowing progress, crop conditions, and weather are updated. This current intelligence is gathered primarily from the countries' newspapers and journals, but agricultural attache reports and weather summaries prepared by U.S. government agencies are also important information sources. The array of information is used subjectively to modify area and yield assumptions. The lack of detailed geographic data on crop location, weather conditions, and input use in these countries limits yield analyses, even by experts in agronomics and meteorology.

The data released by the individual countries are considered fairly reliable, although frequently the lack of information on definitions and methodologies used in generating the data limits analyses. Only Hungary, Poland, and Yugoslavia release crop production forecasts, but these are sporadic and not very comprehensive.

The problem of data availability is perhaps most obvious in the area of Soviet grain production. Between 1958 and 1975, area and yield data were available for a number of grains at the sub-republic level (the Russian Republic spans 11 time zones). Before 1958 and since 1975, even less data have been available. Since 1980, the Soviets have not released even a total grain production figure for the USSR or for most of its major republics. Information on economic factors that affect production is also lacking. For example, the USSR provides no consistent data on the farm prices for crops or on input prices. Data on the proportion of grain area fertilized and fertilizer application rates at even the republic level have been available only since 1974 and release of the 1983 data is behind the usual schedule.

PREDICTING EVENTS

Question. Discuss the usefulness of global monitoring as a tool to predict events such as droughts; pest infestation; soil moisture; floods; crop classification; crop acreage estimates; forest defoliation, logging fires, and avalanches, water runoff and land erosion; and freezes.

Answer. Monitoring of global events relies on a number of sources. For example, USDA receives information on foreign areas from attaches, travelers, press reports, radio broadcasts, and reports from foreign governments, as well as data from ground weather stations and from civil weather and land-observing satellites.

For weather-related events, meteorological data collected at ground sites and transmitted via the World Weather Watch System sponsored by the World Meteorological Organization constitute a primary source of information. For example, data on rainfall, temperature, and other weather variables measured at over 8000 weather stations in countries all over the world are transmitted electronically every 6-12 hours to primary collection and processing centers—one of which is located at Camp Springs, Maryland. These data are made available by the National Oceanic and Atmospheric Administration to the Joint Agricultural Weather Facility of the Department of Agriculture for global monitoring of crop conditions and potential yield estimates. NOAA's polar-orbiting environmental—meteorological—satellites and geostationary operational environmental satellites provide data on movement of large air masses, surface temperatures, clouds, and other parameters. The Advanced Very High Resolution Radiometer, a sensor on the NOAA polar-orbiting satellites, provides data which have proved to be useful in qualitatively monitoring vegetative conditions. Data from the Landsat satellite is used to monitor changes in vegetation.

The synthesis of data from an array of sources is one of the significant features of the monitoring activity of USDA and provides a foundation for reporting and decision making.

Although the situation in an area can be described with reasonable certainty based on personal observation, inference from reports, or detection from sensors at a given time, past or present, prediction of events is another matter. Events that are directly linked to short-term weather events, for example, floods, freezes, water runoff, and possibly avalanches and soil moisture, can be forecast with some accuracy, several days (occasionally a week or more) in advance, provided that adequate data are received in a timely manner. Long-run phenomena related to weather, such as drought, are more difficult to forecast, since they develop very slowly. Some phenomena, such as pest infestation, can be forecast by inference, that is, knowledge of the life cycle of the organism and patterns of infestation can be related to current weather and vegetational conditions to determine optimum periods of development and spread.

While crop yields are directly related to weather conditions, estimates of crop acreage are linked not only to weather variables but to government policies and economic conditions as well. Once crops are planted, personal observation, remote detection, and analysis derived from reports and weather conditions provide the basis for forecasts.

Soil erosion is ultimately dependent upon weather variables, with transportation by wind and water. However, the susceptibility of soil to erosion will initially be determined by such factors as soil type, vegetative cover, and topography. Analysis of all factors can highlight areas where erosion is most likely to occur. Monitoring of these vulnerable areas to detect changes, for example, removal of vegetation, can provide some basis for forecasting erosion should certain weather conditions be present.

Forest defoliation can result from a variety of causes: insects, disease, adverse weather. Monitoring defoliation can be accomplished through on-site observation and by sensors carried on aircraft and satellites. Prediction of defoliation can be based on knowledge of insect and disease cycles and assumptions concerning weather conditions. Inventory of forest fuels, including debris left in logging, and analysis of weather factors can delineate those areas where logging fires could occur.

Prediction of events, such as those indicated, over the long-run can also be based on the probability of occurrence, provided that sufficient historic data are available for analysis.

DATA BASES AND MODELS

Question. What are the limitations of current Departmental data bases and models?

Answer. USDA has the responsibility for conducting a program of economic research, analysis, and forecasting which focuses on issues of broad national significance or about which there is widespread concern. To be effective and to have an impact on public policy decisions, the product of USDA programs must be timely, consistent and have a sound analytic base. This requires a central role for economic models and an accurate and complete data base.

To achieve goals of timeliness, consistency, accuracy and completeness for product output, the Agency has developed and maintains (or has access to) large economic models or model systems in three major program areas: macroeconomic and domestic agriculture, international trade and agriculture, and natural resources.

In the global economy, many complex things are happening at the same time. It is often difficult, if not impossible, to trace the cause and effect relationships because they are masked by other events. With regard to international trade and agriculture, there are difficulties in modeling the world outside the United States. Perhaps most important is the sheer magnitude of the task. Therefore, a variety of modeling and analytic approaches are needed because of the complex and extensive set of interactions under consideration--between international and domestic factors of production, between international markets and national market objectives, between exporters and importers, between macroeconomic and agricultural and trade policies, and ultimately between food requirements as determined by the global market mechanism and actual world food needs.

As we learn about underlying causal structures in global markets, we can produce more complete representations—or models—of these systems and relationships. But the structure and complexity of a global modeling system or analytic framework is perhaps most limited by data. Data quantity and quality, as well as data accessibility, are major issues. The more complex the model or the more geographic detail, the greater will be the data requirements.

USDA, through the Foreign Agricultural Service, the Economic Research Service, and the World Agricultural Outlook Board has a long-term service goal—the provision of international agricultural and economic information and data to the public. The Department currently maintains an international data set in excess of 1,000,000 observations. Included in the data base is information on each country's food and agricultural sector, its macroeconomy, and its international financial position. Data is collected from public and private sources within the countries, the U.S. State Department, the USDA Agricultural Attache/Counselor Service, international organizations and private foundations and research institutions.

The quality and quantity of foreign data is a substantial limiting factor—limiting from the standpoint of timeliness, factual accuracy and the erratic nature of release by foreign governments. Also, it is difficult to find data which are readily comparable across countries. Thus, USDA is highly dependent on data and information on international economic and agricultural variables over which it has little or no control. However, substantive progress has been made on exchange of information and data between foreign governments, international organizations and USDA in an attempt to maintain and collect the most up-to-date and reliable official statistics on foreign economic, agricultural, and trade conditions.

For successful forecasting of trade prospects and requirements, and for implementation of both emergency and nonemergency food aid operations, it is necessary to have accurate and timely information about the food and economic situation in foreign countries—not only information on production prospects, but information on food stock levels, foreign exchange reserves, and the infrastructural capacities of the storage, handling, and transport systems. This information is, all too frequently, unavailable to U.S. program officials because of the general inadequacy of national institutions in a large number of developing countries—most particularly in the poorest—for collecting and analyzing data and information on their food economies.

The capability to collect, verify, disseminate and analyze agricultural statistics in foreign countries varies greatly—from adequate in many of the developed countries to nearly nonexistent in many of the developing countries. Some developing countries in Asia have made great strides in the area of data collection, often with the help of U.S. technical assistance, while elsewhere particularly in Sub-Sahara Africa, progress has been slow. In countries where an institutional data collection activity is nonexistent, information and data which are released often come from ad hoc surveys which are subject to improper survey techniques and poor quality control—resulting in incomplete or inaccurate data.

The Statistical Reporting Service of USDA has a continuing program, through AID, FAO, and the World Bank of providing technical assistance in improving agricultural statistics in developing countries. The program has three principal objectives: (1) improving host country agricultural statistics for agricultural program administration and policy planning; (2)

providing the data and information for measuring the impact of AID development projects; and (3) strengthening the ability of USDA to assess food and fiber production. The quality of USDA data on each foreign country's food and fiber production is often very closely related to the reliability of the foreign country's internal statistical system. Hence, improvements in a country's statistical system helps improve the accuracy of USDA forecasts and estimates for the country.

Program supporting sampling, survey procedures, crop cutting techniques for measuring yield, data summarization and data analysis are underway in Bangladesh, Bolivia, Cameroon, Costa Rica, the Dominican Republic, Ecuador, Egypt, El Salvador, Guatemala, Haiti, Honduras, Indonesia, Jamaica, Liberia, Morocco, Pakistan, Paraguay, Peru, the Philippines, Saudi Arabia, Sierra Leone, Sudan, Thailand, Tunisia, and Turkey.

USERS OF DATA OUTPUT

Question. The users—in-house, other agency, and private—of the Department's global models and forecasts.

Answer. The results of the Department's models and forecasts are used by policymakers, researchers within Government, the university community, farmers and agribusiness firms and the general public. Frequent requests for data and forecast model results are received from Congressional staffs, international organizations and multi-national firms. USDA provides the basic data used by private forecasters and commodity brokers. The Department's forecasts are widely disseminated via press releases to the popular press, farm magazines, and electronic media. Products of the Department's foresight program are widely used by public and private sector institutions in foreign countries.

RESPONSES OF MR. WHITE TO WRITTEN QUESTIONS

1. Describe how the Department's global food model is coordinated with the Department of Energy's global energy model. How are assumptions about world supply and demand and energy prices documented and coordinated between the two Departments:

   -- is there a formal mechanism for the two Departments' modelers as well as policymakers to regularly share information about supply, demand, prices, and assumptions about them?

Coordination of the Department of Energy's global energy model with the various models used by the Department of Agriculture in forecasting the global food situation is informal in nature and takes place primarily at the level of the technical staff responsible for modeling and forecasting in the two departments. The Department of Agriculture does not normally attempt to forecast energy prices but relies on the Department of Energy and other institutions' forecasts of energy prices as input into food supply demand and price forecasts. In making medium-term and long-term forecast of world food conditions (the timeframes within which energy prices are most likely to experience significant changes) the Department's modelers utilize either existing Department of Energy forecasts of energy prices or, if needed, request the Department of Energy to make special forecasts of energy prices consistent with alternative world economic scenarios being considered in the agricultural forecast.

There is no formal mechanism for linking the modeling efforts of the two Departments. However, informal coordination and cooperation between the technical staffs of the two Departments has generally been satisfactory.

2. To your knowledge, prior to 1980 and the Year 2000 Report, had the Agricultural Department analyzed world food production to the year 2000 assuming energy prices higher than 1973 embargo levels?

The Department conducted several studies projecting food supply and demand to 2000 in the mid-1970's. However, these studies did not include any explicit treatment of energy prices. They focused on major demand factors (such as growth in income and population) and supply factors (such as growth in productivity related at least indirectly to fertilizer prices and in turn to energy prices). The Global 2000 study is the only study that included both the capacity to analyze and the assumptions necessary to run alternative scenarios evaluating energy price impacts on agriculture.

There is little direct linkage between world energy prices and U.S. grain treaties with foreign governments. High energy prices do work to raise OPEC export earnings and boost their imports of consumer items such as food. With the U.S. a major food exporter, this tends to increase our sales abroad. However, there were few serious efforts made during the high energy price years to negotiate grain agreements. Grain agreements were signed but in most cases with a different set of countries (i.e., the USSR, China, and Japan rather than the major OPEC members) and for reasons generally unrelated to energy prices.

3. Does the Department have the capability to project the economic effects of international trade agreements such as the International Coffee Agreement?

   -- does it do so?

   -- are such projections used to modify the U.S. position with respect to s uch international food agreements?

   -- does the Department monitor the economic after-effects of international food agreements?

Generally, it is the position of the Department that the United States should not engage in international commodity agreements which may distort natural market forces. The United States should participate in such agreements only if U.S. economic interests are accommodated. It may, for example, be advantageous for the United States to engage in an international agreement, such as the International Coffee Agreement, to assure adequate market supplies and protect U.S. consumers from wide fluctuations in commodity prices.

The Department supports and exercises a substantial analytical capability with respect to projecting the economic effects of international trade agreements. These projections are used to formulate and modify, if necessary, the U.S. position with respect to such agreements. To assure that U.S. economic interests are being suited, the Department continuously monitors the economic consequences of those agreements which are in place.

4. Comment on the assumptions made with respect to food prices' annual change between now and 1990, and the year 2000. A description of how those assumptions are translated into farm price support legislation.

   -- a description of global data models which the Department employs in making forecasts with respect to crop yields, forest production, and rangeland sizes.

   -- by country or world region.

In general, the Department's global foresight activities are not dependent upon making assumptions about annual changes in food prices between now and 1990 and the year 2000. The normal process employed in forecasting future world food conditions involves assumptions about the major factors determining agricultural supply and demand conditions in the United States and the world, projecting these supply and demand conditions, and determining the implied levels of production, consumption, and price. ERS's forthcoming World Food Study is an example of this process. The Department does, at times, perform analyses of the effect on production or consumption of alternative price levels. The long-term trend in agricultural prices in the world, in real terms, has been one of stable or slowly declining real agricultural prices. Our analyses indicate that, with long-term economic growth at or below trend level, real food prices will continue to reflect this long-term stability or downward trend. With higher-than-normal rates of economic growth in the world, real prices for agricultural commodities could begin to rise toward the end of the century.

Projections of future world agricultural supply and demand conditions and resulting prices are one of many considerations upon which farm price support legislation is based. There are many factors which influence world agricultural supply and demand conditions including general economic conditions and domestic and trade policies of the individual countries of the world. Therefore, it is extremely difficult to accurately foresee world agricultural market conditions far into the future. For this reason farm price support legislation based upon a particular forecast of world market conditions is quite likely, during its life, to become inconsistent with actual supply and demand conditions prevailing.

Senator **Mathias**. The next witness is Mr. Lindsey Grant, the former Deputy Assistant Secretary of State for Environment and Population Affairs. Mr. Grant, we appreciate your voluntarily putting your neck in the noose.

TESTIMONY OF LINDSEY GRANT, RETIRED DEPUTY ASSISTANT SECRETARY OF STATE FOR ENVIRONMENT AND POPULATION AFFAIRS

Mr. **Grant**. Thank you, Senator. I am delighted that you are holding these hearings, and I appreciate the opportunity to testify before them.

I am a retired Foreign Service officer and a consultant. As far as I know, all retired Foreign Service officers are consultants. It may be a law.

Senator **Mathias**. They shouldn't retire so soon, and more of them should ultimately retire as Ambassadors.

Mr. **Grant**. I have had something of a worm's eye view, looking at national decisionmaking for a number of years.

At one time or another, I have served as a staff member of the National Security Council, as a member of the Policy Planning Staff in the Department of State, and as Deputy Assistant Secretary of State for Environment and Population Affairs. In that last assignment, I was intimately involved in the "Global 2000 Report."

During those experiences, two things particularly troubled me: The tunnel vision that characterizes our national decisionmaking; and the difficulty of bringing demographic, resource, and environmental considerations systematically into the process.

Since then, I have been thinking about how the process can be improved, and writing on the subject. The Environmental Fund has published a booklet that I wrote on the subject, titled "Thinking Ahead." I have provided copies to the committees, and I understand that further copies are available from the fund.[1]

What do I mean by "foresight?"

In its current use, the term is more specific than the dictionary definition. It is, quite simply, a systematic process for bringing the lateral implications—the side effects and the probable long term consequences of proposed actions—into the decision process as those actions are comtemplated. And it is a way of looking ahead to see looming issues that may require action.

Put even more simply, it is the process of looking at alternative courses of action and asking, "What if * * * and then what if"—and then getting the best possible answers into the minds of decisionmakers.

Foresight requires that the Government be able to bring a wide spectrum of the best available expertise to bear on policy questions—public and where possible private expertise. The unintended consequences of an action may be more important than the intended ones. For example, the income tax specialist or the welfare technician may not even recognize that a tax change or a new welfare system may have very important demographic consequences. The foresight process should bring in the social scientist and the demographer to look at those possible consequences.

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[1] The booklet referred to was accepted for the record and may be found in the subcommittee files.

Good foresight must systematically bring in such advice when decision papers are being prepared—before the decision is taken.

Good foresight requires that the experts be identifiable to each other and to the policy process, that the experts' terminology, definitions, and assumptions be clear, so that they can use and evaluate each others' work.

The process should be as politically unfettered as possible. We seem to have a national penchant, like ancient Athens, for rushing into things. For their own protection, decisionmakers should protect their advisers from pressures to deliver projections that suit their predetermined policy choices.

National foresight is improved if it is practiced, and perhaps the best practice is to invite the experts to cooperate periodically in preparing joint projections such as "Global 2000." This sort of exercise may identify trends and their interactions and forewarn how they may affect the pursuit of national goals such as full employment or national security. Just as important, these exercises help to identify gaps in our information and weaknesses in our thought processes. Finally, such exercises help to provoke a national debate about trends and what they may mean. If the debate leads to some sort of consensus, it may help to generate the political base that politicians need if they are to address the issues.

So much for the effort to describe foresight.

Let me mention a few things that foresight is not.

It is not prediction. It does not say that such-and-such will happen in 10 years. Anybody who confuses it with prediction is a fatalist; he assumes that humans cannot affect their own destinies. The real purpose is the opposite of prediction; it is to warn of the implications of trends or decisions, to help leaders maneuver to avoid the ill consequences and pursue the good ones.

By extension, foresight is not a static projection but rather a rolling process. Data change; information improves; projections must be regularly adjusted and the latest best guess used when a decision is at hand. The decisionmakers must weigh both the importance and the likelihood of a projected consequence. A projection of the Mexican labor force in 2000 is pretty solid, because those people are already born. A projection of Mexican fertility in the same year is much more fragile because it depends on decisions and circumstances that have yet to occur.

Foresight is not central planning or a step on a slippery slope to a planned economy. It is the improvement of understanding. What the political leaders do with that knowledge is another matter. There is no built-in logic leading toward greater governmental intervention. On the contrary, if you were to apply the foresight process today to a choice of economic systems, your advisers would probably survey the performance of different systems worldwide and warn you of the economic penalties of a trend toward statism.

There are some harsh critics of foresight in the present administration. They have, I think, created a straw man by misunderstanding or overstating what foresight undertakes to do. They have criticized foresight as tending to substitute bureaucratic judgment for the free market as a determinant of national choices, but even

Adam Smith never saw the invisible hand of the market as the sole director of national destinies. They ridicule foresight by showing that specific past decisions have been wrong, ignoring the points I have just made that foresight is not a static prediction.

Such critics, I think, tend to make the perfect the enemy of the good. If human foresight cannot be perfect, they say, then don't try to look ahead.

Change does not stop because we refuse to think about it. "See no evil" is not a very good guide to policymaking. A ship's captain does not refuse to use radar just because it sometimes gives false echoes. Even in this laissez-faire administration, decisions are made—or omitted—that will shape the Nation's future.

Much of the current reaction against foresight comes, I suspect, because it was popular in the previous administration, because the critics don't like what they read in "Global 2000," because they associate it with environmentists—and because excessive claims are sometimes made for it by its proponents.

I would urge the administration to give up this parochialism. Foresight should not be seen as the exclusive preserve of the environmentalist. There is just as much reason to examine the likely impact of a proposed action upon unemployment—for instance—as upon the environment. The use of the techniques does not prejudge the results, unless of course the environmentalists turn out to have been right.

This administration has every reason to improve its foresight capabilities for a reason thoroughly congenial to it: better and more efficient government. Foresight is not a magical formula; it is simply a better way to conduct the Government's business.

You may legitimately ask: Doesn't the Government already use foresight?

Yes; all governments try. I assume that even cannibal kings, if they were to remain king, pondered the likely consequences before they declared a war or consumed a rival. My point—and one of the central points of the Global 2000 exercise—is that we don't do it very well.

Let me illustrate: The Government does not provide any systematic guidance to the first step of good foresight: finding out who knows about what. There is no inventory of data bases, nor any listing of offices by topic. There is a true story: An energy specialist in the Department of Energy, trying to improve the forecast of the Nation's demand for energy, discovered that the energy demands of agriculture and specifically irrigation had heretofore been projected simply as a fixed ration with the demands of manufacturing—a practice justified only by an historical ratio somewhere in the past. This is the kind of thing that can lead to bad forecasts. Anybody remotely familiar with vicissitudes of irrigation in the past two decades will recognize that such an ephemeral ratio is no guide to its forthcoming energy requirements.

Our energy specialist undertook to get a better fix on how much energy irrigation may require, from irrigation specialists. His first problem was to find one. There is no published directory for the Department of Agriculture. The last one, now out of print, is dated 1979. Our specialist's search took him through several offices at Agriculture, to the list of contributors to Global 2000 and finally to a private study group in Washington before he found his man, back in the Department of Agriculture.

The Government is a big place. If it is opaque to the insider, it is nearly impenetrable to the outsider. Yet access to the information hidden there is important, not just to an arcane study in the Government itself, but to basic decisions by business. The lead time to bring new energy on line is notoriously long, and the capital requirements are formidable. Private energy and power companies, planning their own future, could well be in touch with that specialist, and they would like to understand his methods, his data and his sources, for comparison with their own. Both he and they would profit from the interchange.

Some departments do publish directories, but they are not necessarily very helpful. Let me pose a hypothetical problem: You are a businessman contemplating investment or trade in South America. You would like to know what your chances are of getting your money back out, so you are interested in the Government's projection of the balance of payments with South America. You buy all the directories you can from the Government Printing Office, and you start to look. Who do you call? Do you telephone:

The Bureau of Inter-American Affairs, the Planning and Analysis Staff, or the Office of Monetary Affairs in State?

The Bureau of International Economic Policy and Research, the Bureau of International Policy and Research, the Office of Economic Development Policy and Planning, the Associate Director for National Income Accounts, the Associate Director for National Analysis and Projections, the Associate Director for Regional Economics, or the Associate Director for International Economics in Commerce?

The Deputy Assistant Secretary for International Monetary Affairs, the Deputy Assistant Secretary for Trade and Investment Policy, or the Deputy Assistant Secretary for International Economic Analysis in Treasury?

All of the above? None of the above?

That's just the beginning. Getting in touch. I could go on. There are similar breakdowns at every stage of the decision process, from informing the experts of a pending decision to getting their advice back into the decision process.

It is not customary to praise the United Nations for efficiency, but they are far ahead of the U.S. Government in making data sources available. The inquirer can walk down to the U.N. bookstore in Washington and buy a three-part directory of U.N. Information Systems that lists publications, specialized information sources by topic and country, data banks and their availability—with names, addresses, and telephone numbers. And all regularly updated.

Let me try, very briefly, to show why this whole subject is important.

Let me give just two examples, one old, one new.

A generation ago, we embarked simultaneously upon one of the Nation's greatest moral crusades—ending racial discrimination—and one of its greatest engineering programs—the interstate highway system. Both thoroughly desirable. One unanticipated byproduct has, however, undone much of what was intended. School busing, to achieve one of those ends, precipitated white flight from the cities, which was made easier because they could commute to work on the new highway system. The cities were resegregated, improverished by the loss of part of their tax base. Would we have pursued our objectives in somewhat different ways if we had enlisted advice of urban specialists as to the probable results of this combination of developments?

For a present example: As the president of the AAAS has pointed out, we live in the midst of "one of the most drastic transformations any species has ever experienced." The speed and scale of the technological revolution poses questions of the effects of change at a rate that decisionmaking has not had to face before. Let me cite some issues and their connection to just one current decision.

What are some of the changes that are going on? For one, the evidence is rapidly mounting that fuel consumption patterns in the industrial world may need to be sharply altered if acid precipitation is to be controlled and northern temperate zone forests to be preserved. For anothers, there seems to be a growing conviction among scientists that atmospheric accumulation of carbon dioxide will lead and probably already is leading to a climatic warming trend. For another trend, apparently quite unrelated, accelerating computerization and automation are resulting in astonishing labor productivity in industries that can accumulate sufficient capital, but parallel to that phenomenon is the spread of unemployment and a two-tiered labor force, with sweatshops reappearing in our cities. Even at the top of the business cycle, national unemployment is nearly twice as high as the goal we set ourselves in the Full Employment Act, and it is much worse in the urban ghettos and among the minorities we were trying to help in my first example.

With the will, we should be able to resolve those problems. In all three seemingly disparate issues, however, the scale of the problem is fundamentally related to the size and growth rate of our population and our labor force.

Immigration presently constitutes close to one-half our annual population growth, and the proportion is rising. Last year, after years of preparation, both Houses of Congress debated our national immigration policy—and failed to pass a bill. My criticism is not so much of the failure to pass the bill as of the issues that surfaced in the debate. Immigration policy should have been debated in the light of its relationship to other broad national issues such as I have described, and that is the purpose of foresight. In fact, most of the debate was about trivia. Our statistical system is so bad that you had no idea how many people you were talking about. The chief concern among many Congressman seems to have been the possible impact on the Hispanic vote, and yet little effort was made to learn what Hispanic attitudes really are.

Is that the way to run a railroad?

If I simplify, I apologize. Time is short, I would be happy to elaborate later, if you wish.

What would I urge you to do?

First, let me address the executive branch.

I do not argue for the creation of new bureaucracies. Let us better use the ones we have, rather than creating a new think tank to engage in turf wars with the existing departments.

There has existed an Office of Statistical Policy, variously titled and located. It was abolished early in this administration, and there has been a continuing contraction of statistical world. I would recreate such a body, with participation across the Government, as a Foresight Working Group. Drawn from among existing statistical and planning bodies, it would supervise the creation of directories to identify where expertise is available about specific topics of national interest, from balance of payments to ground water quality. This information would serve Congress and the public, as well as the executive branch. The group would coordinate terminology to make statistics mutually usable. It would set standards of documentation and would promote informal communications within government. It would report to, and have disputes resolved, by, a Foresight Policy Group.

Both of these would be connected with an ombudsman in the White House, who would have no substantive ax to grind but would be responsible to see that the best available advice about the ramifications of proposals is brought into the policy documents before decisions are made. He would work with and be assisted by the Foresight Policy Group, whose members would have a vested interested in assuring that their departments' viewpoints are heard in the policy process.

The administration in 1981 created seven Cabinet Councils that seemed to offer the promise of better coordination. They were abolished this month in favor of an Economic Policy Council and a Domestic Policy Council, coequal with the National Security Council. I hope that these councils will find ways to communicate, as they failed to do in previous incarnations. Our national future—our national security broadly defined—may be more deeply shaped by our immigration policy or what happens in the urban ghettos than by a revolution in Central America.

The authority exists. The Executive does not need a law to improve foresight. If a statute is needed, the Environmental Policy Act of 1969 [NEPA] states the case for foresight more eloquently than I have done. It has not been much used in major decisions, although the law requires that it be used. If the requirements of NEPA were honestly met, and if it were accompanied by parallel examination of economic and budgetary impacts, we would be a long way toward a functioning foresight process.

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Congress has done some commendable work on foresight. NEPA itself is a testimonial to your interest, and you have created other machinery to keep you aware of trends and their implications: the GAO, CRS, OTA, the Congressional Clearinghouse for the Future, the Environmental Study Group—and hearings such as this one.

There have been foresight bills in earlier Congresses, and their authors are to be commended. I think particularly of the Gore/Gingrich bill (H.R. 3070) and the Hatfield/Ottinger bill (S. 1025–H.R. 2491). I would urge that the proposals in those bills be refined and that the Senate entertain a new foresight bill.

Such a bill should urge upon the executive branch the type of systematic foresight machinery that the administration has failed to create. It would require that environmental, economic, and budgetary impact statements accompany legislative proposals from the Executive. It would require Congress to beef up its own foresight processes.

Finally, such a bill would call for the periodic submission by the President of a report on national and global trends and their interactions, and their implications for the pursuit of national goals. This report would provide the basis for a congressional response.

The report and the response would be purely analytical. From them, however, the executive branch and the committees of Congress would be invited to prepare policy change needed to accommodate and deal with the trends described.

I realize that Senators and Congressmen need to be elected, and that special interests can help that process. I have, nevertheless, great respect for institutions that have adapted so well through two centuries, of remarkable change. The tempo of change has accelerated. The Nation needs a more systematic way of scanning those changes and adjusting to them. Perhaps the very process of involving the public in this debate is your best protection from the demands of special interests. An honest appraisal of the issues we face as a nation may help to rally the public to understand and support the policies that you believe necessary.

Thank you, sir. I am ready for any questions you may have.

Senator MATHIAS. Thank you very much. I think you probably heard Mr. Boggs say that there was a distinction between foresight in the private sector and foresight in the public sector, and the distinction that he drew, as I understood it, was that in the private sector, the response to foresight would be voluntary whereas the effect on the public as far as government exercise of foresight would be coercive. I wondered what you thought about that distinction. Is it less coercive for the automobile industry, say, to decide it is only going to make big cars or only going to make small cars, whatever the case may be, and offer them to a coerced public, than it is for the Government, say, to make some prudent forecast of what may happen and shape policy?

Mr. GRANT. As you can imagine, Danny Boggs' viewpoint was one of the things that I was attempting to address today.

I think that there is simply no support for this argument that if the government tries to figure out what may be happening when it is shaping its policies is itself going to lead us inexorably down into statism. I think that you have every reason to see as best you can what the implications are of what you are doing, and it doesn't mean that, having seen them, that you will decide that you need to impose an economy by ukase. I agree with you that in a sense some of the private decisions force our hands as much as government decisions, but I think that the really critical point here is that foresight should be separated from this image of inevitable movement toward planning. I think that only those who don't want any government really can believe that foresight in government is a bad thing; and I think if they don't like government they had better show us what social institution they want to create that will substitute for it, because individual business cannot substitute, nor can academe.

Senator **Mathias**. Mr. White in his testimony said that the Department of Agriculture anticipated the remarkable increase in agricultural production in China at the time the policy changes were made by the Chinese Government. I am wondering whether, in your days in the Department of State, you foresaw similar changes. For example, when land reform was adopted by Peru, did you anticipate what the effect on agricultural production would be?

Mr. **Grant**. I couldn't answer that because I didn't keep that close to Peru. I was a China specialist for about——

Senator **Mathias**. Well, pick another country, if you will.

Mr. **Grant**. May I take China, because I was a specialist on China for 25 years and did reporting on the agricultural movements, both in Taiwan and the mainland.

With respect to China, I think it is true that we never saw the big changes ahead. The best that we specialists could do would be, I think, to understand rather quickly what seemed to have happened, but our ability to predict Chinese behavior was just incredibly bad.

I did, I remember, in the Great Leap Forward, myself become involved—this was the late 1950's—in that debate because I did not think that they could reasonably be getting the increases in production that they claimed. This turned out to be the case. They were letting statistics serve politics.

Basically, I think what you find in the reporting process from government—from the Department of State particularly—is that you do some quantitative work where you can handle figures. You can get some idea of weather patterns and then adjust your assumptions as to how much production they are going to get this year, and this will in turn affect your view as to Public Law 480 requirements or market competition on the other hand. This kind of thing can be quantified, and it is done pretty regularly by a combination of agencies, including the Department of State, Agriculture.

The big things, the things that surprise you and come down the road, you adjust to, and then you simply say, they are going through a tremendous change—a collectivization, for instance, of Chinese agriculture. We cannot imagine that they are going to get away with this without some disruption of production. This in turn may lead in certain directions. This is a sort of seat-of-the-pants, intuitive, and not quantitative process. In the case of China it has not been very successful. In other cases, it can work. I was in Cyprus, for instance, where I think we almost always called the shots right because it was a less impenetrable society.

Senator **Mathias**. And do you think the Department currently possesses this capability?

Mr. **Grant**. I have redefined the problem to make it possible to say yes, I guess. I have not kept up too closely with the Department's analytical capabilities, but I am in touch with the China specialists from time to time. I don't think that I would change my guess as to how it is happening. We can sense that certain developments may have ramifications, and you can say those ramifications may be such-and-such. Once we really believed that the process of undoing the communization of Chinese agriculture was going to stick, then we could see that it was going to lead to a great deal more production. Combined with some success in bringing population growth down, this did, I think, pretty clearly lead to an expectation of an improved agricultural scene. Whether they could quantify it, I don't know, and I don't see the classified material any more.

Senator MATHIAS. How quickly would these assessments find their way into policy? For example, if the Department of Agriculture was making some agreement with another country, or the Department of the Treasury making some economic agreement, how would your assessments——

Mr. GRANT. Get to them?

Senator MATHIAS [continuing]. Get to them?

Mr. GRANT. It would depend on the agreement and whether it was simply another country. Specifically, it might. If we were, for instance, negotiating another grain agreement with the Soviet Union, I am pretty sure that our estimate of Chinese food import requirements or exports would get into it. But there is a broader thing that you were pursuing earlier: How do we get these estimates into the general policy climate? You were pursuing that problem with respect to agricultural estimates, and what fell out of your questions, was, obviously, that we may be exporting less food than we used to because of the competition. If we are exporting less food, what does this do for our balance of payments? If that does something to balance of payments, can we also see any implications for the budgetary support requirements of the American farmer? Can we then bring this into the process of asking, "What will our budget be?" I don't think this happens. I think this is exactly what does not happen, and that's why foresight is needed. Somebody needs to be able to tell the administration, "Even though you dearly want more money for defense, you do have other penalties that you pay when you try to get that money, and here they are," and give them a list of them, and let everybody be heard. This does not happen. I think it should, and I think that the foresight process and these periodic reports would tend to force it.

Senator MATHIAS. Well, I would agree, and perhaps we will have to end on that note of agreement, but I will ask you the same question, if you would be willing, if it is necessary, to respond to some questions?

Mr. GRANT. I would be delighted to if I can, sir.

Senator MATHIAS. Augment the record.

Mr. GRANT. Yes, sir.

Senator MATHIAS. Thank you very much for being with us.

[Mr. Grant's prepared statement follows:]

FORESIGHT: WHAT IT IS. WHAT IS NEEDED.

statement of

LINDSEY GRANT, Consultant

before the

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

AND THE

SUBCOMMITTEE ON GOVERNMENT EFFICIENCY
AND THE DISTRICT OF COLUMBIA,

U.S. SENATE.

April 30, 1985.

Lindsey Grant
5505 Durbin Road
Bethesda, MD 20814
(301) 652-8940

I.

I am a consultant and a retired Foreign Service Officer.

At one time or another, I have served as a staff member of the National Security Council, as a Member of the Policy Planning Staff in the Department of State, and as Deputy Assistant Secretary of State for Environment and Population Affairs. In that last assignment, I was intimately involved in the Global 2000 Report.

During those experiences, two things particularly troubled me: the tunnel vision that characterizes our national decision making; and the difficulty of bringing demographic, resource and environmental considerations systematically into the process.

Since then, I have been thinking about how the process can be improved, and writing on the subject. The Environmental Fund has published a booklet that I wrote on the subject, titled Thinking Ahead. I have provided copies to the Committees, and I understand that further copies are available from the Fund.

II.

What do I mean by "foresight"?

In its current use, the term is more specific than the dictionary definition. It is, quite simply, a systematic process for bringing the lateral implications -- the side effects and the probable long term consequences of proposed actions -- into the decision process as those actions are contemplated. And it is a way of looking ahead to see looming issues that may require action.

Put even more simply, it is the process of looking at alternative courses of action and asking "what if... and then what if" -- and then getting the best possible answers into the minds of decision makers.

Foresight requires that the Government be able to bring a wide spectrum of the best available expertise to bear on policy questions -- public and where possible private expertise. The unintended consequences of an action may be more important than the intended ones. For example, the income tax specialist or the welfare technician may not even recognize that a tax change or a new welfare system may have very important demographic consequences. The foresight process should bring in the social scientist and the demographer to look at those possible consequences.

Good foresight must systematically bring in such advice when decision papers are being prepared -- before the decision is taken.

Good foresight requires that the experts be identifiable to each other and to the policy process, that the experts' terminology, definitions and assumptions be clear, so that they can use and evaluate each others' work.

The process should be as politically unfettered as possible. We seem to have a national penchant, like ancient Athens, for rushing into things. For their own protection, decision makers should protect their advisers from pressures to deliver projections that suit their predetermined policy choices.

National foresight is improved if it is practiced, and perhaps the best practice is to invite the experts to cooperate periodically in preparing joint projections such as Global 2000. This sort of exercise may identify trends and their interactions and forewarn how they may affect the pursuit of national goals such as full employment or national security. Just as important, these exercises help to identify gaps in our information and weaknesses in our thought processes. Finally, such exercises help to provoke a national debate about trends and what they may mean. If the debate leads to some sort of consensus, it may help to generate the political base that politicians need if they are to address the issues.

So much for the effort to describe foresight.

III.

Let me mention a few things that foresight is *not*.

It is not *prediction*. It does not say that such-and-such will happen in ten years. Anybody who confuses it with prediction is a fatalist; he assumes that humans cannot affect their own destinies. The real purpose is the opposite of prediction; it is to warn of the implications of trends or decisions, to help leaders maneuver to avoid the ill consequences and pursue the good ones.

By extension, foresight is not a static projection but rather a rolling process. Data change. Information improves. Projections must be regularly adjusted and the latest best guess used when a decision is at hand. The decision makers must weigh both the *importance* and the *likelihood* of a projected consequence. A projection of the Mexican labor force in 2000 is pretty solid, because those people are already born. A projection of Mexican fertility in the same year is much more fragile because it depends on decisions and circumstances that have yet to occur.

Foresight is not central planning or a step on a slippery slope to a planned economy. It is the improvement of understanding. What the political leaders do with that knowledge is another matter. There is no built-in logic leading toward greater governmental intervention. On the contrary, if you were to apply the foresight process today to a choice of economic systems, your advisers would probably survey the performance of different systems worldwide and warn you of the economic penalties of a trend toward statism.

Grant 4

There are some harsh critics of foresight in the present Administration. They have, I think, created a straw man by misunderstanding or overstating what foresight undertakes to do. They have criticized foresight as tending to substitute bureaucratic judgement for the freemarket as a determinant of national choices, but even Adam Smith never saw the invisible hand of the market as the sole director of national destinies. They ridicule foresight by showing that specific past decisions have been wrong, ignoring the points I have just made that foresight is not a static prediction.

Such critics, I think, tend to make the perfect the enemy of the good. If human foresight cannot be perfect, they say, then don't try to look ahead.

Change does not stop because we refuse to think about it. "See no evil" is not a very good guide to policy making. A ship's captain does not refuse to use radar just because it sometimes gives false echoes. Even in this laissez-faire Administration, decisions are made -- or omitted -- that will shape the nation's future.

Much of the current reaction against foresight comes, I suspect, because it was popular in the previous Administration, because the critics don't like what they read in Global 2000, because they associate it with "environmentalists" -- and because excessive claims are sometimes made for it by its proponents.

I would urge the Administration to give up this parochialism. Foresight should not be seen as the exclusive preserve of the environmentalist. There is just as much reason to examine the likely impact of a proposed action upon unemployment (for instance) as upon the environment. The use of the techniques does not prejudge the results -- unless of course the environmentalists turn out to have been right.

This Administration has every reason to improve its foresight capabilities for a reason thoroughly congenial to it: better and more efficient government. Foresight is not a magical formula; it is simply a better way to conduct the Government's business.

IV.

You may legitimately ask: doesn't the Government already use foresight?

Yes. All governments try. I assume that even cannibal kings, if they were to remain king, pondered the likely consequences before they declared a war or consumed a rival. My point -- and one of the central points of the Global 2000 exercise -- is that we don't do it very well.

Let me illustrate.

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Analysis and Projections, the Associate Director for Regional Economics, or the Associate Director for International Economics in Commerce?

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There have been foresight bills in earlier Congresses, and their authors are to be commended, I think particularly of the Gore/Gingrich bill (H.R.3070) and the Hatfield/Ottinger bill (S.1025-H.R. 2491.) I would urge that the proposals in those bills be refined and that the Senate entertain a new foresight bill.

Such a bill should urge upon the Executive Branch the type of systematic foresight machinery that the Administration has failed to create. It wuld require that environmental, economic and budgetary impact statements accompany legislative proposals from the Executive. It would require Congress to beef up its own foresight processes.

Finally, such a bill would call for the periodic submission by the President of a report on national and global trends and their interactions, and their implications for the pursuit of national goals. This report would provide the basis for a Congressional response.

The report and the response would be purely analytical. From them, however, the Executive Branch and the Committees of Congress would be invited to prepare policy papers suggesting the directions of legislation or policy change needed to accommodate and deal with the trends described.

VII.

I realize that Senators and Congressmen need to be elected, and that special interests can help that process. I have, nevertheless, great respect for institutions that have adapted so well through two centuries of remarkable change. The tempo of change has accelerated. The nation needs a more systematic way of scanning those changes and adjusting to them. Perhaps the very process of involving the public in this debate is your best protection from the demands of special interests. An honest appraisal of the issues we face as a nation may help to rally the public to understand and support the policies that you believe necessary.

Thank you.

Senator **Mathias**. Our final witness for the day is Dr. Valfells, whom we are glad to welcome here today.

I understand, Dr. Valfells, that you are the author of a report entitled "Iceland 2000." [1]

Mr. **Valfells**. That is right.

Senator **Mathias**. Of which the committee is pleased to have a copy.

Mr. **Valfells**. Thank you, Senator.

TESTIMONY OF AGUST VALFELLS, AUTHOR, "ICELAND: 2000," REYKJAVIK, ICELAND

Mr. **Valfells**. Senator, I am honored that you should seek my opinion on the matters being considered by your committee here, and you did originally communicate with me posing certain questions and I shall try to answer those questions in the same order that you posed them, and the topics of my answers will essentially reflect your questions.

Your first question pertained to the usefulness and limitations of global models, and I certainly think that they are useful, though limited, and without models we can make no decisions. On the other hand, if the models are too inaccurate, or if we believe in them with too much inflexibility, then decisions based on such models are apt to lead to undesirable results.

Now, human global society, let alone the biosphere and the other environment, is much too complex to model accurately. Factors which at one time are secondary can unexpectedly become primary ones and lead to completely unanticipated effects. As an example of how minor factors can become major factors, and unanticipated ones, before the Second World War there was hardly anybody that anticipated the effect that the release of nuclear energy eventually had upon world politics and the economy of nations. As a matter of fact, very few people even knew about the possibility of nuclear energy, for use in war or peace, and it is most unlikely that the possibility of its release would have been incorporated in any economic or political model made at that time, and the forecasts based on such a model would have been totally in error.

Now, even if a model can be made very accurate, and decisions are based on that model, the decisions themselves will affect its validity, and all models will eventually go awry, and too rigorous an adherence to the decisions based on the models will lead to undesirable results, or may lead to undesirable results.

And globally there is danger that the authorities in nondemocratic societies may try to coerce those societies into conforming with their models, whether they are realistic or unrealistic ones.

Now, even the best of models—as an example, the one depicted by the Global 2000 study—have their shortcomings and err in many of their future predictions, but they are still the best and we have to base our decisions on them. Without such modeling, we cannot make but short-term decisions and have a very limited mastery over our own fate. In short, I think we should make models to the best of our ability, make them on a probabilistic basis, and try to separate the main factors from the minor ones, although as I pointed out earlier, minor factors can evolve into major ones, and we should make decisions based on those models as flexible as possible so as to accommodate the differences between the model and reality when the two start diverging.

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[1] The report referred to may be found in the subcommittee files.

Now, maybe this brings to mind the statement that Harold Macmillan made not too long ago, shortly before his death, that the only moral politics is pragmatic politics.

Now, the second question—or the third, rather, pertained to the acceptance of models and associated forecasts by policymakers, and since models, perhaps other than economic models, are relatively recent phenomenon, their effect on national policy matters around—I'm sorry, their effect on national policymakers around the world appears to have been very limited indeed.

Two exceptions to this may be noted. Perhaps these are exceptions because the factors involved are so clearly important to the future of humanity, and these exceptions are the forecasts as to what will happen during a nuclear war and how it will be to live in an overpopulated world. Both are really based on modeling, although of a limited scope in each case. Both carry portents of disaster, if nothing is done to prevent that diaster, and both have affected the national policy of scores of nations.

Perhaps the lesson we can draw from this is that humans will try to do something if they feel threatened. But to understand a future threat, modeling is necessary.

Now, perhaps an auxiliary answer to the question as to whether national policymakers have been influenced by models—that answer is inherent in the fact that many of the world's ideologies are based on models. When these models are incorrect or nonobjective in their reflection of reality, or when they reflect desired rather than realistic pictures of society, and then when they affect national policy, especially in dictatorial societies, they can often lead to grief, and our century certainly abounds with such examples.

Now, your last question pertained to the process of developing the "Iceland: 2000" report and as introductory remarks to that, I think I should explain that as everybody knows, Iceland is a very small society. The population is only one one-thousandth of that of the United States, about 230,000, and the economy is necessarily much simpler than that of the United States. Nonetheless, it is a developed nation and the way of life is not much different in the two nations, and what Iceland lacks in the diversity of its domestic manufacturing is made up by imports.

There are probably two areas where Icelandic technology is second to none, and that is in fishing and the harnessing of geothermal energy. Hydroelectric technology there is also on par with that of any other nation, except for size.

Now, the mainstay of the economy is fishing. The country is self-sufficient in the basic agricultural products except grains. Hydropower and geothermal heat are found in abundance in relation to the size of the country and its population. A somewhat, but not much, larger percentage of the population is engaged in agriculture than in the United States. Light and service industries employ comparable fractions of the population in both countries, whereas, of course, a larger percentage of the population in Iceland is engaged in fishing, whereas a larger fraction of the population is engaged in industry in the United States. There is no heavy industry there to speak of.

In short, though, there are many similarities in both societies, in spite of the fact that one is amongst the world's smallest societies and one is amongst the world's largest, and this is borne out by some economic studies such as those that have been done by the Wharton Econometric Forecasting Institute or Associates in Philadelphia.

Now, the national statistics in Iceland have been meticulously kept for a long time, probably longer than in the United States, but, of course, they are not as complex.

Now, in planning for the study, a good deal of thought was initially given to the identification of what were the important factors, and which ones were not, and when these had been decided on, accumulation of data was undertaken. A facilitating factor was that no data in Iceland is classified except some information pertaining to NATO and State Department information.

It is easy, because of the smallness of the society, to establish personal contact with governmental employees, and they are generally free to discuss that information if anybody wants to know, and to obtain the information I needed for the report I generally asked knowledgeable people where it would be found, secured the publication, if it was published, or approached the public or private employee that had access to the information, introduced myself, explained the purpose of my inquiry and, in every case, I was supplied with the information requested in a helpful manner, just like I imagine I would have been in a small American town.

Now, basically, the foundations of the Icelandic economy, although not in order of their importance, are the country's vegetation or tillable land, which reflects a renewable but greatly overtaxed resource after 1100 years of habitation. The tillable land has diminished by a factor of 2 during this time and it has been totally denuded of forest. Some conservation measures are now being taken but it would have been better if they had been taken several hundred years ago, but nobody did any forecasting then.

The mainstay of the economy are the fishstocks, which are also a renewable resource, and it has traditionally yielded an ever-increasing bounty with the improvement of fishing technology, but this resource now seems to be fully exploited and not able to provide the basis for further economic growth.

Quotas have had to be established limiting the catch of individual vessels, in order to prevent overfishing. At the time I wrote the study, "Iceland: 2000," the maximum catch had not been achieved, and nobody was thinking about quotas at that time, but some years later it became necessary to establish them.

Now, the history of the development of the fishing industry in Iceland is a lesson in how a relatively few people can, in the span of some decades, by employing ever more developed technology, fully tax a resource which seemed almost infinite in extent to the pioneers that developed that technology.

In summary, it shows how quickly the limits of a resource can be reached with exponential growth in the rate of its exploitation.

Hopefully, the history will also show how sensible limits in the exploitation of such a renewable resource can prevent its overtaxation and decline.

Now, the final resource that Iceland has is the hydroelectric and geothermal energy of the country, and only about 10 percent of this has been harnessed, and the potential for continued economic growth will have to be based on the utilization of this resource, and since both hydro power and geothermal power are inexpensive, this provides a possible basis for energy intensive industry in Iceland which should be very competitive with the comparable industries of other nations because of lower energy crisis. But also because of the late development of such industries, it would be possible to avoid many of the problems which have been associated with such industries in older industrial nations, and problems which essentially we know about now because they have manifested themselves in older nations.

Now, the study, "Iceland: 2000," was commissioned by the Icelandic Power Co., and it was distributed in some hundreds of copies domestically, which corresponds to hundreds of thousands of copies in the United States on a per capita basis, and it was distributed mostly to individuals in key positions.

In retrospect, it is felt that the study was not used directly as a basis for any policy decisions, but it did have an effect. The effect manifested itself in that one could see that the ideas put forward in the study found their way into the public domain and the mass media. Politicians started talking about the necessity of diversifying the economy and not basing it mainly on fishing, and the media started publishing articles on power intensive industries, and so forth. All in all, the study did have an effect of disseminating ideas into the general public forum, some of which became the basis for later policy decisions.

I hope, Senator, that answers your questions, and I am more than pleased to agree to your request to include the study in the hearing records. I thank you for your inquiry, and if there are any further questions, I would be more than delighted to answer them.

Senator **Mathias**. Well, we appreciate your testimony. I should note the common interest that we have in the State of Maryland with the Government of Iceland because the fish which are caught in Icelandic waters by Icelandic ships are brought to an Icelandic processing plant in Maryland, and we are very happy to have that strong economic tie.

I might also note a personal tie in the fact that a longtime member of the Icelandic Government is Matthias Matthias, with whom I must be related in some way.

You say that the "Iceland: 2000" report was commissioned by the power company.

Mr. **Valfells**. Yes.

Senator **Mathias**. What do you think was the motivation of the company in asking you to prepare the report?

Mr. **Valfells**. It originally started in that I was asked to try to assess the total economic value of the hydropower in Iceland. I am an engineer by profession and I was asked by the chief engineer of the company to undertake a study to try to assess the economic worth of the hydropower resources, and it just evolved into a more extensive study.

I expressed an interest in making the study more extensive, and the company agreed. That is how it came about.

Senator **Mathias**. As a result of the publication of "Iceland: 2000," have there been any adjustments in policy either by the government or by private sector interests?

Mr. **Valfells**. I think there have, not directly based on the report, but the report perhaps was the first publication to state and quantitatively show or discuss the limits that there would be to the fish catch, and also show in the same place how greatly overtaxed the agricultural soil had been throughout the ages, and about 4 or 5 years afterward the catch started—reached its limits and started to decline, and by that time there was considerable discussion as to how this could be met, and there have been policy changes now in that fishing quotas have been established that the government sets every year.

Now, this year there can only be, let's say, 700,000 pounds of such-and-such species caught, and the vessels are limited in what they can catch.

Now, there has been debate as to how this total limit should be effected. Perhaps in a communistic economy, the government vessels would do all the catching and no private decisions would be made. Perhaps in a social democratic economy, the government will say to Tom, Dick, and Harry, "You can all catch equally," or "You can catch according to what you have previously caught, according to your historical track record." And in a free enterprise economy, the government could say, "We are going to allow," for example, "700,000 tons of this species to be caught, and we will sell fishing licenses which allow the highest bidder to have the largest quota," or simply say that the permit to catch so many hundreds of thousands of tons will go for so and so much, and then the companies which were most efficiently operated would best be able to afford the fishing licenses.

And there has been some debate in Iceland as to which approach should be taken, and the approach which has been taken is that there are quotas given to various and sundry companies based on historically what they have caught, but then these quotas can be sold within certain limitations.

Senator **Mathias**. Let me just ask you one further question. Suppose there had been no projection of a limit. Suppose that no action had been taken. Regardless of the method by which the limit was achieved, what would have been the effect on Iceland?

Now, Mr. Boggs in his testimony this morning said that it didn't matter that Theodore Roosevelt predicted that the forests of this country would be denuded, that there would have been some self-correcting mechanism that would have developed. Do you believe the same kind of self-correcting mechanism would have developed in Iceland?

Mr. **Valfells**. No, not without some anticipation of what was going to happen in the future. But the same thing would have happened to the fishstocks as happened to the agricultural land, that the tragedy of the commerce would have manifested itself, and the fishstocks would have declined unquestionably, because it had happened previously with some species, individual species such as herring and capelin, of which there had been very large catches in prior years, and then when the overfishing just precipitously manifested itself with an enormous decline in the catch the years after it had been overfished.

So I am sure that the total fish caught in the ocean would have declined, in relation to forests, and the early comment about forests. Iceland was forested at the time of settlement but some hundreds of years ago just about all remnants of forest had been lost.

Senator MATHIAS. Too many Viking ships were built.

Mr. VALFELLS. Well, that might very well be, or just too much charcoal made and too much grazing, too. There was no limit on grazing of sheep.

Senator MATHIAS. Well, your comments on the fish I think are confirmed by our experience with the rockfish in Chesapeake Bay, which was fished too much too long, and now we've had to put a total ban on taking any rockfish at all, which is what happens when the private sector doesn't exercise the restraint that it should.

We appreciate very much your being here. There may be some further questions which will occur as we review the record, and I hope you will be willing to contribute still a few more answers.

Mr. VALFELLS. I certainly would be happy to. Thank you very much.

Senator MATHIAS. To provide for that possibility and to provide for a chance for other statements to be filed, we are going to keep this record open until May 15.

Thank you once again for being with us.

Mr. VALFELLS. Thank you.

[Mr. Valfells' prepared statement follows:]

Hrauntunga 46
Kopavogur,
Iceland

April 25, 1985

Senator Charles McC. Mathias, Jr.
Chairman
Subcommittee on Governmental
Efficiency and the
District of Columbia.
Washington D.C. 20510
U.S.A.

Dear Senator Mathias:

Thank you for your letter of April 2. I am honored that you should seek my opinion on the matters being considered by your subcommittee. I shall try to answer the points raised in your letter in the same sequence as you raise them:

ON THE USEFULNESS AND LIMITATIONS OF GLOBAL MODELS.

I certainly think that global models are useful, though limited. Without models we can make no decisions. On the other hand, if the models are too inaccurate or if we believe in them with too much inflexibility, decisions based on such models are apt to lead to undesirable results. Human global society, let alone the biosphere and other environment, is much too complex to model accurately. Factors which at one time are secondary can unexpectedly become primary ones and lead to completely unanticipated effects. Hardly anyone before the Second World War anticipated the effect that the release of nuclear energy evetually had upon world politics and the economy of nations. As a matter of fact very few people even knew about the possibility of nuclear energy, for use in war or peace, and it is most unlikely that the possibility of its release would have been incorporated in any economic or political model made at that time and forecasts based on such models would have been totally in error. Even if a model can be made very accurate and decisions are based on that model, the decisions themselves will affect its validity. All models will eventually go awry and too rigorous an adherance to decisions based on the models will lead to undesirable results. There is also danger that the authorities in non democratic societis will try to coerce society into conforming to their models, be they realistic or unrealistic ones.

Even the best of models (for example as the one depicted by the Global 2000 study) have their shortcomings and err in many of their future predictions, but they are still the best we have to base our decisions on. Without such modeling we cannot make but short term decisions and have very limited mastery over our own fate. In short, I think we should make models to the best of our ability, make them on a probabilistic basis, try to separate the main factors from the minor ones (although, as pointed out earlier, minor factors can evolve into major ones), and make decisions based on the models as flexible as possible so as to accomodate the differences between the model and reality when the two start diverging. (Maybe this can all be summed up in Harold Macmillan's statement that the only moral politics is pragmatic politics).

ACCEPTANCE OF MODELS AND ASSOCIATED FORECASTS BY POLICY MAKERS.

Since models, other than economic ones are of recent vintage, their effect on national policy makers around the world appears to have been very limited indeed. Two exceptions to this may be noted; perhaps these are exceptions because the factors involved are so clearly important to the future of Humanity. These exceptions are the forecasts as to what will happen in a nuclear war and how it will be to live in an overpopulated world. Both are really based on modelling, although of a limited scope in each case. Both carry portents of disaster, if nothing is done to prevent that disaster and both have affected the national policy of scores of nations. Perhaps the lesson to draw from this is that humans will try to do something if they feel threatened. To understand a future threat, modeling is necessary.

An auxiliary answer to the question as to whether national policy makers have been influenced by models is inherent in the fact that many of the world's ideologies are based on models. When these models are incorrect or nonobjective in their reflection of reality, or when they reflect desired rather than realistic pictures of society, then when they affect national policy, especially in dictatorial societies, they can often lead to grief. Our century certainly abounds with such examples.

THE PROCESS OF DEVELOPING THE ICELAND 2000 REPORT

To begin with, it should be emphasized that Iceland is a very small society (the population is only 230,000) and the economy is necesserily much simpler than that of the United States. None the less, it is a developed nation and the way of life is not much different in the two nations. What Iceland lacks in the diversity of domestic manufacturing is made up by imports. There are probably two areas where Icelandic technology is second to none, and that is in fishing and harnessing geothermal energy. Hydroelectric technology there is also on par with that of any other nation, except for size. The mainstay of the economy is fishing. The country is self sufficient in basic agricultural products except grains. Hydropower and geothermal heat are found in abundance in relation to the size of the country and its population. A somewhat, but not much, larger percentage of the population is engaged in agriculture than in the United States. Light and service industries employ comparable fractions of the population in both countries, whereas a larger percentage, naturally, is engaged in fishing in Iceland. There is no heavy industry. In short, there are many similarities in both societies, in spite of one being amongst the worlds smallest and the other amongst the world's largest. (This is borne out by such reports, for example, as the "World 20-Year Outlook" published in 1985 by the Wharton Econometric Forecasting Associates of Philadelphia). National statistics are meticulously kept in Iceland and have been for a long time.

Initially, in planning for the study, Iceland 2000, a good deal of thought was given to the identification of what were the important factors, and which ones were not. When these had been decided on, accumulation of data was undertaken. This was of course continued as needed during the progress of the report. A facilitating factor was that in Iceland there are, apart from those pertaining to some classified NATO and State Department information, hardly any restrictions on the dissemination of any governmental information by any public employee. The smallness of the society makes the establishment of a personal contact very easy. To obtain the information needed for the report I generally asked knowledgeable people where it would be found, secured the publication if it was in published form, or approached the public or private employee that had access to the information, introduced myself, explained the purpose of my inquiry, and in every case was supplied with the information requested in a helpful manner; in other words, just like in an American small town.

Basically, the foundations of the Icelandic economy (not in order of their economic importance, though) are:

a) The country's tillable land, which reflects a renewable but greatly overtaxed resource after 1100 years of habitation. The tillable land has diminished by a factor of two during this time and been virtually totally denuded of forest. (The history of soil erosion in Iceland comes to mind when one reads about the loss of topsoil in the still very fertile Midwest of the United States, and although mechanisms of soil loss are different, causes one to ponder whether enough is being done for soil conservation, in Iceland or the American Midwest).

b) The fishstocks, which are also a renewable resource that has traditionally yielded an ever increasing bounty with the improvement of fishing technology, but which seems to be fully exploited now and not be able to provide the basis for further economic growth. Quotas have had to be established, limiting the catch of individual vessels in order to prevent overfishing. The history of the development of the fishing industry in Iceland is a lesson in how a relatively few people can in the span of some decades, by employing ever more developed technology, fully tax a plentiful renewable resource, which seemed almost infinite in extent to the pioneers in devoloping that technology. In summary, it shows how quickly the limits of a resource can be reached with exponential growth in the rate of its exploitation. Hopefully, the history will also show how sensible limits in the exploitation of such a renewable resource can prevent its overtaxation and decline.

c) The energy resources of the country, which consisist of relatively abundant hydropower and geothermal heat. Less than ten percent of these resources have been harnessed, and they give the potential for continued economic growth if utilized to furnish power for energy intensive industries, which, because of the cheap power could competitively produce for export. Sensible planning in the construction of such industries can circumvent many of the problems that have been encountered by older industrial nations, now that experience has shown what the problems are.

The study, Iceland 2000, was commissioned by the Icelandic Power Company. It was distributed in some hundreds of copies domestically, (corresponding to hundreds of thousands in the United States, on a per capita basis), mostly to individuals in key positions. In retrospect it is felt that the study was not used directly as a basis for any policy decisions, but it did have an effect. This effect manifested itself in that one could see that the ideas put forward in the study found their way into the public domain and mass media. Politicians started talking about the necessity of diversifying the economy and not basing it mainly on fishing (The study was published before the fishing catch had reached its maximum, but did forecast with reasonable accuracy what the maximum catch would be). The media started publishing articles on power intensive industries, etc. All in all, the study did have an effect by disseminating ideas into the general public forum, some of which became the bases for later policy decisions.

I hope that answers your questions, senator, and I am more than pleased to answer your request for the inclusion of the text of Iceland 2000 in the hearing records in the affirmative.

Sincerely,

Agust Valfells

Agust Valfells.

Senator Mathias. The committee stands in recess, subject to the call of the Chair.

[Whereupon, at 12:43 p.m., the committee was adjourned subject to the call of the Chair.]

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

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May 13, 1985

The Honorable Charles McC. Mathias, Jr.
Chairman, Sub-Committee on Governmental Efficiency
  and the District of Columbia
United States Senate
Washington, DC 20510

Dear Senator Mathias:

Thank you for your letter of March 15 requesting testimony for the hearings on "Global Foresight Capability of the U. S. Government."

In particular, you asked that I address the following questions:

1. What followup has there been by CEQ, to recommendations I made in a consultant report to CEQ, "Improving the Government's Capacity to Analyze and Predict Conditions and Trends of Global Population, Resources and Environment" (1982)?

My first recommendation was to not create an office of global or national planning in the White House or anywhere else. This recommendation has been followed very carefully.

My second recommendation was to allow the existing foresight capabilities to continue to be used and to improve their efficiency by establishing a small office in the Executive Office of the President to follow closely the assumptions being built into the agencies models and the maintenance, documentation and construction of these models. In the Reagan Administration, responsibility for such monitoring and coordination has been assigned to Mr. Danny Boggs, who in effect is what he himself has termed the "Foresearer General of the United States." Mr. Boggs retains this responsibility even now that he has moved from the

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White House staff to the Department of Energy where he is Undersecretary. He has personally drafted some policy statements for the Reagan Administration in the area of global foresight, but most of these policy statements have never been approved or released. He has also allowed some monitoring and coordination to go on through the Council on Environmental Quality and through the Global Issues Working Group. All of this work has all been quite secret (for political rather than national security reasons), but from frequent leaks it is clear that very little is being done by Mr. Boggs, by CEQ, and by the Global Issues Working Group. I prepared the entire *Global 2000 Report* in three years; in four and a half years, Mr. Boggs *et* al. have produced next to nothing. Little or no attention has been given to even the straight-forward, technically-simple politically-innocuous steps that could be taken to improve the efficiency of the Government's existing foresight and policy analysis work. Furthermore, every statement by Mr. Boggs shows an inflexable ideological hostility to efficiency in government through foresight. In his testimony for this hearing, for example, Mr. Boggs states that he is *not* concerned by the finding that the Government's foresight work *is* highly inconsistant and contradictory and in this same testimony equates foresight and policy analysis. The indifference -- even hostility -- of Mr. Boggs and his colleagues to thoughful, consistent, long-term globally-orientated policy analysis is a root cause of enormous costs and ineffiencies in Government operations.

My third recommendation was that there be more funding for long-term analysis and research in institutions outside of government. Quite the opposite has happened. Funding for such work has almost totally dried up. The only exception is for funding of analysis related to the Strategic Defense Initiative, which at best presents a rather narrow perspective on global issues.

My fourth recommendation was that the White House encourage the Congress to undertake a careful examination of the foresight work done for the Congress by Office of Technology Assessment, Congressional Research Service and Congressional Budget Office and to analyze the future foresight needs of the Congress. On the basis of this examination and analysis, the Congress might decide to strengthen its own foresight capabilities rather than leaving this area largely as a prerogative of the Executive Branch. To my knowledge, the White House has not encouraged the Congress in these directions.

My fifth recommendation was that, given the strong foresight capabilities of the Japanese government (especially in MITI) and the important influence these capabilities have on U.S.-Japanese trade competition, the White House might encourage the active participation of American business in improving the quality of government foresight. CEQ did fund a World Wildlife Fund study of American business use of the global data maintained by the Government, but to my knowledge nothing has been done with the study. Also, nothing has been done to enlist the interest of

American business in the government models used to analyze the global data -- which was an essential aspect of my recommendation.

2. What is the status of evolution of agencies' sectoral global models into an integrated global model?

   - * The Department of Agriculture global food model (GOL) was lost when it was left unused on the computer for six months and was automatically deleted by the computer; there was no back-up copy. Many millions of dollars of data collection and analysis were lost through this "inefficiency." The United States, which aspires to market globally its agricultural production, now has no global food model with which to evaluate alternative policies and programs. Careful analysis in the early 1980s with the GOL and other models could have contributed significantly to an understanding of how American agriculture was headed for trouble. The loss of the GOL model was a direct result of White House and USDA indifference to carefully considered analysis of the global food situation and has led to governmental inefficiencies and costs on a scale seldom seen, to enormous suffering in the U.S. farm and banking areas, and to enormous suffering in many other parts of the world, especially in Africa.

   - * The Department of Energy Policy Office has developed, prior to the Reagan Administration, a new energy-policy model under the direction of John Stanley-Miller. The Reagan Administration has allowed this new model -- which is quite good -- to replaced the less useful IEES model used previously by DOE.

   - * The Joint Chiefs of Staff have developed an unclassified global model (FORECASTS) for use in preparing background analysis for the Joint Long-Range Strategic Assessment, which is the basic document from which long-range forces planning decisions flow for all of the services. JCS staff feel that a model illustrating the dynamics of global population growth, resource consumption and environmental stress is essential for an understanding of the causes of future conflicts and wars, and therefore also for planning the future of the nations military forces.

3. How has the level of communication between and among agency modelers coordination and documentation of assumptions in their models changed?

Until the Global 2000 study, the government's professionals concerned with foresight in the areas of global economics, demography, resources, and environment worked independently and in isolation. The top government experts in these areas had not even met each other until they were assembled for the Global 2000 work. The Global 2000 study led them to a process of cooperative work. These professionals are all still with the government, but there has been little or no governmental encouragement for them to continue to work cooperatively and efficiently with each other.

4. What efforts have been made to encourage communciation between agency modelers and the private sector or to coordinate and document assumptions in their respective models?

I am not aware of any government efforts to encourage communication of this kind.

5. What efforts and progress have been made to develop/improve the global foresight capability in other countries?

There has been much progress abroad. This is outlined in an article I wrote for the International Encyclopedia of Peace. A copy of this article is enclosed for the hearing record.

I have also prepared (with Ms. Jennifer Robinson) a report for the Agency for International Development on the long-term outlook for rural development. This report, "Rural Development and Global Trends: Perspectives for the 1990-2010 Period," illustrates how the efficiency of major programs of the government (in this case, the whole AID program) could benefit from improved foresight capabilities. A copy is enclosed for the hearing record.

I have written President Reagan twice concerning the tremendous opportunity he has to commission a new global study. Copies of these letters are enclosed for hearing record.

Finally, there is a growing interest among religious leaders in foresight relating to the future of the creation. I have written an invited paper on this subject for a theological journal, Word and World. The article, "The Future of the Creation: The Central Challenge for Theologians," is enclosed for the hearing record.

You have my permission to include in the hearing record my 1982 report, "Global 2000 in Germany."

Thank you for your interest in governmental foresight and efficiency, which amount to much the same thing.

Sincerely,

Gerald O. Barney

Gerald O. Barney

GOB:pbc

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May 15, 1985

The President
The White House
1600 Pennsylvania Avenue
Washington, D.C.

Dear Mr. President:

I am writing to bring to your attention several points made by Danny Boggs in his testimony before Senator Mathias on April 30. Danny's testimony strongly supports the thrust of my letter to you of April 16 concerning the Government's global foresight capabilities (copy enclosed).

In his testimony Danny noted that many people continue to hold the Global 2000 study in high regard. This observation is supported both by my personal experience and by a recent Heritage Foundation report which found that the Global 2000 study continues to have an enormous influence and has become the standard work in the field of global studies.

Danny emphasized that in his view there are many deficiencies in the Global 2000 work. Others (including the original authors) have noted deficiences in this government report. Danny suggested that it would be unfortunate if such a flawed study were allowed to continue as the standard.

Finally, in answer to a question, Danny told Senator Mathias that he was quite sure that the Reagan Administration could produce a study that would have equal or greater influence than the study done by the Carter Administration.

The obvious implication of Danny's testimony is that the time has come for the Executive Office of the President to prepare a new, improved global study. I share this view.

A new global study would provide many benefits for you and your Administration. A high quality Presidential study of global development and security -- something a bit broader in scope even than the Global 2000 Report -- would not only replace Global 2000 as the international standard, but would also strengthen your reputation as an international statesman and provide a positive influence extending long beyond the end of your second term.

I have a number of specific ideas about how such a study might be done and know several conservative Republicans who could do an excellent job of managing the study. I would be pleased to share these ideas with you or your staff if that would be helpful.

Sincerely,

Gerald O. Barney

Gerald O. Barney

GOB:nbc

BARNEY AND ASSOCIATES, INC.
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April 16, 1985

The President
The White House
1600 Pennsylvania Avenue
Washington, DC

Mr. President:

I am writing to urge you to initiate the preparation of a major report on the future that could replace the Global 2000 Report to the President as the government's most comprehensive statement on the future.

The Global 2000 Report, that I directed, has had an enormous impact, even larger than described in the recent Heritage Foundation paper, "Half-Truths and Consequences: The Legacy of Global 2000." It has sold 1.5 million copies in seven languages, has become the model for several national studies, and continues to be used throughout the world in thousands of courses. You have an opportunity to prepare a report on the future that would have equal or larger influence.

A Reagan Administration study looking into the world's 21st century would begin with several advantages not enjoyed by the earlier work. Your Administration is already well established and into its second term. You have the past work to draw on and to learn from. You have the newly developed global model at the Joint Chiefs of Staff, which was not available to us for the earlier study.

It would have been premature to have undertaken a new report during your first term, but enough time has now passed and enough change has occurred that public attention here and abroad is ripe for a new analysis. Serious work on Global 2000 began in September of the first year of President Carter's term and required three years for its completion. Starting now, you have the opportunity to produce an improved and up dated report that could replace the Global 2000 standard.

On April 30th Senator Charles Mathias will hold hearings on up dating the Global 2000 Report. I hope you will use the occasion of these hearings to announce the initiation of a new detailed look into the 21st century.

If I can be of any assistance to you in describing the several 21st century studies now in progress in several other nations or in connection with lessons learned in the earlier work, please let me know.

Sincerely,

Gerald O. Barney

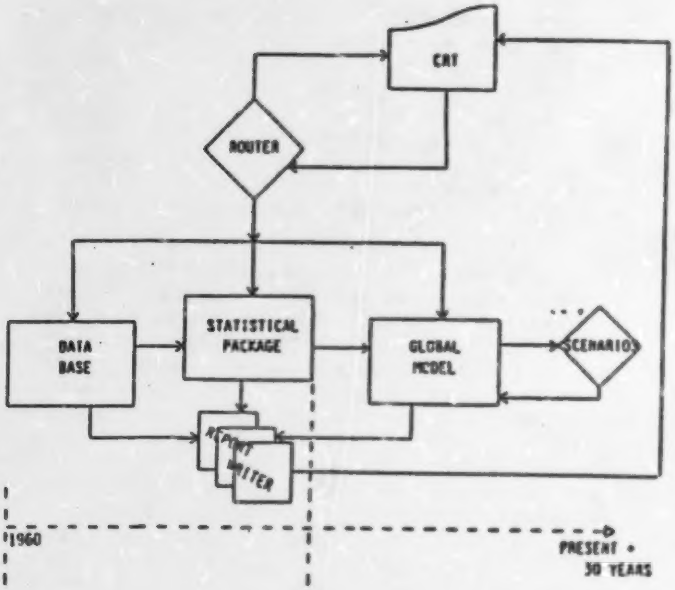
Gerald O. Barney

GOB:pbc

cc: Senator Charles Mathias
Danny Boggs
Alan Hill

The first global modeling effort in this new generation, FORECASTS, is being developed by Prospective Decision Models Inc., under contract to the Organization of the Joint Chiefs of Staff. (While called FORECASTS, which is an acronym, this system does not provide forecasts, still less predictions.) FORECASTS was designed as a decision-support system composed of four linked subsystems:

PDMI'S FORECASTS SYSTEM


CRT
ROUTER
DATA BASE
STATISTICAL PACKAGE
GLOBAL MODEL
SCENARIOS
REPORT WRITER
1960
PRESENT + 30 YEARS

a country-specific data base which provides historic and current information, a set of statistical procedures which can be used to analyze the data and do short-term projections, a global model FORECASTER which can be used to identify long-term megatrends of national security importance for the United States, and a report-writer which can be used to format the information provided by each of the other three subsystems in a meaningful way.

To be useful, a decision support system must be prepared in easy-to-use formats aimed for technically uninitiated users. To make FORECASTS easy to use, an ordinary language question and answer sequence prompts users at four levels of proficiency, from one who has no computer expertise to the most computer-proficient user. For example, in a "tutorial" mode the system will guide the user through the different alternative paths of operation of FORECASTS by using extensive on-line documentation. For those users that know the system well, FORECASTS will direct their queries so that unnecessary steps will be bypassed.

The second generation of global modeling, directed at providing the means of informing and facilitating the planning process, has, above all, the opportunity to be useful. This requires the design of a system tailored to the client's needs. FORECASTS was developed in close cooperation with the OJCS to meet its specific decision-making/planning mandate: to address the "messes" which can be characterized as strategic, global, multi-issue and long-range.

These systems must be flexible in order to respond to changing problems since, despite decisions taken, problems do not stay solved. To provide a flexible tool, the FORECASTS system has been designed to address questions across three dimensions: time, types of geo-political unit of analysis (country or region), and sector of analysis. By combining several of its subsystems, FORECASTS permits the user to call up countries, select indicators and invoke a variety of mathematical functions for any period from 1960 to five years beyond the present; or, under the long-range projection, to regionalize the world and test scenarios (grouped into international policies, domestic economic policies, domestic human resource policies, and domestic natural resource policies) for up to 30 years beyond the present. Like previous global models, FORECASTER operates with a set of country aggregations called regions (a single country can also be a region). However, to permit the user the ability to rearrange groupings to correspond with the issue he is analyzing or with country groupings on which he is focusing, FORECASTER has the option of on-line aggregation of countries into user-selected regions.

And, of course, of most importance, the new global decision support systems must give the user the opportunity to explore significant issues of concern to his planning, decision mandate. For example, given the objectives of OJCS analysts, FORECASTS can be used to provide information on such strategic global questions as:

- What countries had the highest ratio of energy use to economic output prior to the 1973 embargo? Following the 1973 embargo?
- If world demand for copper were to follow its historic pattern for the next five years, what be the global shortfall or surplus relative to production?
- Given demand trends, which of the super-alloys is likely to be exhausted first? In which country?
- What would be the economic and social consequences if the U.S., Canada, and Mexico were to form a common market?
- What would be the impact on the social service delivery system and on the employment situation in the U.S. for the next generation if the Simpson-Mazzoli bill were to be passed? Defeated? [This bill concerns immigration -- JM]
- Are there conditions under which the Latin American debt can be repaid in a timely fashion? What are they?
- Given sectoral returns on investment, combined with deliberate government policies what are the major manufacturing countries likely to be during the next several decades?

The second generation of global modeling promises to be distinguished as the time when global models became a regularly used element in corporate and government decision-making/planning processes. Their value in capturing the dynamic linkages among the elements in a problem set and providing the analyst with information on the impact of alternative choices is being recognized. In an age of uncertainty, where risk assessment, based on probable trends and futures, is acknowledged to be a necessary means of gaining critical information, an integrated decision foresight capability can capture and broaden the audience that has been sought by global modelers for the past fifteen years.

But the new global modeling efforts will be successful only to the extent that they have the following characteristics:

- independent of a preconceived message;
- integrated into a decision support system which fits into the institutional decision-making/planning process;
- tailored for particular needs for particular clients;
- easy to use;
- useful in addressing the issue of concern to the client;
- flexible and adaptive to changing circumstances.

Built on the solid foundation of the past fifteen years, second generation global modeling holds the promise of providing insights into the prospective futures which can help planners and decision makers to address the "messes" contained in the Predicament of Mankind. By including components which provide information on the past, the present, and the probable futures, second generation global modeling can provide a better understanding of what has happened, where we are now, and where we may be going.

UPDATE ON FORECASTS

(Submitted by the Joint Chiefs of Staff)

The FORECASTS system has been accepted from the contractor and has been installed on the Joint Data Support Systems Center computer. Demonstrations of the system's capabilities have received an enthusiastic response from prospective users and initial training is now underway. The initial class includes members of the Joint Staff and the Joint Data Support Systems Center, as well as planners from the Army and Marine Corps.

The primary use which we foresee at this time is in long-range planning, where it will be used to develop ideas about the nature of non-military aspects of the strategic environment 20 years from now. By helping to analyze interdependencies which will exist between the US and the rest of the world, the system will assist in identifying US long-range interests as well as strategic capabilities and vulnerabilities. This will provide the starting point for the development of possible strategies for pursuing US interests and the derivation of requirements for forces and equipment.

Although FORECASTS has been procured primarily to support long-range planning, the data base which has been developed to support it provides a wealth of country-specific historical and current (now up through 1980) data. There are over 1,000 indicators covering population, society, resources, economy, and trade for each of more than 130 countries. For most indicators a time series of values covering the past 20 years is available. Since the system is thus, by its nature, able to deal with current or short-range policy analysis, we expect that other planners besides just those who deal with the long range will find the system useful.

At the present time, we need to absorb the powerful capability which FORECASTS provides, and although we expect that its use will spread, we have no current plans for expanding the capabilities of the system.

We are however now beginning the first update of the data base to bring it current as of 1982. This is about as current as it is possible to have complete data since the data comes from a variety of sources, mostly public (government, UN, World Bank), and takes some time to be developed and published. Given the wide range of aspects of a given country on which data has to be collected, the identification and choice of sources is an important consideration as is the smoothing and interpolation of data to fill in missing values (e.g., population for years between censuses). The data collection and update is done by contractor, supported by consultants recognized as authorities in their fields. As the use of the system grows, we will be able to profit from the feedback from users, both on the accuracy of the historical data and on the plausibility of projections and the simulated interactions of social and economic variables over time.

In addition to testing the validity of the system and its data, there are two other areas on which we will need to concentrate. First is the training of analysts to use the system. The mechanics of running the system are straightforward, but with such a powerful system, the validity of results will depend on how good the analyst is--whether he or she has a feel for what makes sense and for how to pose useful questions. FORECASTS will make good analysts more productive--it will not turn laymen into analysts. The second area for continued emphasis is improvement in the response time for the system. Due to the number of users now on JDSSCs IBM 4341, the response time for the system, particularly when countries are being regrouped into different regions, is currently longer than desired. This situation should be improved by the programmed addition of computer capacity within JDSSC.

We do not expect FORECASTS to predict what the future will be. We do expect it to help us think systematically about what some aspects of that future might be like.

Statement of

Admiral B. R. Inman, USN, (Retired)

Chairman, President, and Chief Executive Officer

Microelectronics & Computer Technology Corporation

Submitted to the

Senate Committee on Government Affairs
Subcommittee on Government Efficiency and The District of Columbia

May 31, 1985

GLOBAL FORECASTING ABILITY OF THE UNITED STATE GOVERNMENT

In my thirty years of government service, I was a voracious consumer of information, and I had the opportunity to observe first hand our capability to understand where trends are taking us and how we may affect those trends. Because of that experience, I commend you for your initiative in undertaking this analysis and I thank you for the opportunity to share some thoughts.

The forecasting capability of the United States government can be traced back as far as 1908, when the National Conservation Commission was established to help prevent future scarcities in our national resources. In 1929, President Hoover's Research Committee on Social Trends was formed to study current social trends and to help point out areas of future concern. Of course, in terms of forecasting ability, the Hoover Administration is best known for the 1929 assertion that "prosperity is just around the corner."

Franklin Roosevelt's commitment to use government planning to achieve social goals, as well as his commitment to conserving national resources, gave forecasting a prominent role in the early years of his administration. The National Planning Board was established in 1933 under the auspices of the Department of the Interior's Public Works Administration. The President sought to move it to the White House and give it the lead role in developing a comprehensive plan for the development of the nation's rivers, a move fought by Secretary of the Interior Harold Ickes and other cabinet members. In compromise, the National Resources Board was formed under Secretary Ickes. A 1934 report from the new Board addressed the use of land, water, minerals, related public works, and made recommendations for national policies for their use and control.

Congress defeated President Roosevelt's attempts to establish a national planning agency. After establishing an Executive Office of the President, he re-established the planning group in his executive office. The onset of World War Two brought a shift in emphasis to post-war planning, with FDR instructing the Board to collect, analyze and collate constructive plans for public and private action after the war. In the face of continued Congressional opposition, the Board was disbanded in 1943.

Forecasting came into greater prominence with the activist economic policy implementation of Keynesian economics. Economic forecasts during the post war period were very poor guides, generally forecasting a return to mass unemployment by mid-1946.

Renewed attention to the future of the nation's natural resources in the post-war period sparked the formation of President Truman's Materials Policy Commission in 1951. The high rate of consumption of those resources during the war, particularly minerals, combined with the rise in the price of materials caused by the Korean conflict made it clear that our supplies were limited. The Commission's 1952 report, Resources for Freedom, was a comprehensive study of the current and future resources situation, but it failed to address important factors such as population trends and environmental factors.

Concern over the future of our natural resources continued to spur government efforts to improve and/or institutionalize long-term forecasting into the policy process. By the mid-1960's, attention was also being focused on monitoring and forecasting social trends in order to develop policy alternatives. In 1969 President Nixon created a National Goals Research Staff in the White House to provide information and long-term analysis, but the staff was abandoned shortly before its report was issued in 1970. Since that time, there have been a number of unsuccessful propopsals to create a separate agency to provide long-term analysis of policy issues.

Despite the increase in its forecasting capability, the government has not taken full advantage of long-term forecasting in policy development. The Global 2000 report assessed the government's ability to conduct long-term analyses of world trends in population, resources and the environment as impressive. It also assessed the principal limitations in the government's long-term global analytical ability: models for various sectors were not designed to be used together in a consistent and interactive manner. They were created at different times, using different methods, to meet different objectives, with little thought given to how they could all be interrelated. As a result, they cannot project a comprehensive, consistent image of the world, and there has been little direct interaction among the agencies' sectoral models.

Forecasting has the potential to positively contribute to the formation of public policy in four ways. First, forecasting methods are a valuable means of assessing the impact of existing policies and current trends. By doing so, we can reduce the number of problems that emerge as surprises, as well as set priorities among problems that will require policy attention. The failure to understand demographic or economic trends can cause significant damage, because their adverse affects will not become fully evident until the 21st century.

Second, forecasting is an essential tool in monitoring international as well as national situations in order to better identify early signs of potential problems (or potential opportunities). Although government forecasting came into use during the period prior to World War Two, the forecasts of that war came almost exclusively from journalists. Throughout the entire decade of the 1930's, there was not a single article in Political Science Quarterly that attempted to forecast the onset of hostilities.

Third, forecasting provides the tools for the formulation and testing of a wider range of policy choices available to government. Although forecasts cannot tell us with certainty what will happen in the future, they do have the ability to describe what is likely to happen or the probability of different outcomes. In addition, they can be used to test the consistency of assumptions and predicted outcomes for different policy options.

Finally, forecasts have the potential to provide a framework for consistency between short-term and long-term analyses as well as across agency jurisdictions. One of the most significant outcomes of the Global 2000 study was its assessment of government forecasting capabilities: the executive agencies of the federal government cannot provide the President with internally consistent projections of world trends in population, resources, or the environment. The models and data used by various agencies are full of contradictions and inconsistencies. Therefore, the report concluded, the projections and policy analyses made by the agencies "almost certainly" underestimate the severity of the long-term problems facing the nation and the rest of the world. The analytical foundations of policy analysis and foresight in the United States, the study concluded, are seriously flawed.

In recent years there has been growing interest in government efforts to anticipate the problems, opportunities and conditions of the future. A number of factors have contributed to this interest:

** Past failures to anticipate or plan for national and international trends are well documented.

** The private sector has been quick to adopt forecasting techniques into their strategic planning, outpacing government in both methods used and results obtained.

** Major global forecasts conducted in the last decade have indicated that the continuation of current trends can be expected to result in growing environmental, economic, and political problems. These forecasts have also demonstrated the complexity and interdependency of the world's physical and socioeconomic systems.

** The increasing rate of technological change, while holding great promise, is raising many questions about how these changes will affect the world. There is recognition that the impact technology will have is a function of policy choices made today and in the near future.

The increasing use of forecasting techniques can improve our ability to effectively address long-range issues by first anticipating conditions, then allowing policy-makers to formulate policies and programs to meet the challenges they present.

The need for increasing the capability of the federal government to employ forecasting in the policy-making process is evident. There are, however, political and institutional barriers that hamper our forecasting ability. Our traditional approach to policy-making has often been too short-term and reactive.

To ensure that long-range impacts are taken into consideration, foresight capabilities must be given more emphasis and upgraded, either through the creation of a separate organization in the Executive Office of the President or by strengthening the foresight responsibilities of the Congressional Research Service.

As I mentioned previously, one of the problems of government forecasting is that models for various sectors have not been designed to be used together in a consistent, interactive way. An inventory of existing methodology is needed, along with efforts to coordinate model development and documentation, is needed to address this shortcoming. Individual agencies certainly should retain their internal forecasting capability, but an Executive Office agency or CRS should be given responsibility for promoting data and method consistency.

In a period in which the government is cutting back on the amount of data it collects, it is important to analyze the adequacy of data sources, identify deficiencies in existing databases, work to correct those deficiencies, and decrease the reliance on private (and possibly biased) sources. The ability to forecast trends and their impact requires reliable and timely data, as well as an awareness that many seemingly unrelated factors may affect the outcome.

Finally, the results of our forecasting should be unclassified to the extent possible, allowing broad dissemination and analysis. It is critical that we protect sensitive intelligence information from release, but it is also critical that we have a consistent set of assumptions and projections which is publicly available.

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Congress of the United States
OFFICE OF TECHNOLOGY ASSESSMENT
WASHINGTON, DC 20510

JOHN H. GIBBONS
DIRECTOR

July 24, 1985

The Honorable Charles McC. Mathias, Jr.
Chairman
Subcommittee on Governmental Efficiency
  and the District of Columbia
Committee on Governmental Affairs
United States Senate
Washington, DC 20510

Dear Mac:

By letter dated May 15, 1985, you requested a brief summary of relevant portions of the ongoing OTA assessment on "Federal Government Information Technology: Congressional Oversight and Civil Liberties" for the record of your April 30, 1985, hearing on "Global Foresight Capabilities of the Federal Government." The requested summary is provided in the following paragraphs. Please note, however, that this is a summary of work in progress. I expect that the assessment results will be available in the fall.

Three major aspects of this study relate to global foresight. The first is information technology planning by Federal agencies. OTA is examining both the current status of the information technology infrastructure and the ability of Federal agencies to plan for future use of the technology in ways that take advantage of opportunities for innovation in carrying out agency missions -- including the foresight dimensions of those missions. We are assessing various options that could help agencies more fully realize such technological opportunities.

The second relevant aspect of the study is electronic collection and dissemination of public information. The data base for foresight activities consists of many different kinds of information -- information that is frequently collected or developed by or for the Federal Government and is "public" information (as opposed to private, proprietary, or classified information). OTA is examining trends in the collection and dissemination of such information, the current and potential use of information technology, and issues and options that may warrant congressional attention. (Note that the treatment of this topic will be relatively limited, in view of resource constraints and the possibility of additional study at a later time).

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The third relevant aspect of the study is computer-based decision support and modeling. One of the major analytical techniques used in global foresight is computer modeling. Indeed, the Global 2000 study and most other global trend studies are heavily dependent on computer modeling. OTA is surveying the Federal agencies with respect to their use of computer modeling and computer-based decision support techniques (all the way from simple spreadsheet software to computer-based decision conferences to computer conferencing). We are assessing possible options for improving the Government's use of modeling and decision support, which, if realized, would also strengthen the analytical infrastructure on which foresight activities depend.

At the present time, I anticipate that this assessment will be completed in late 1985. The final project advisory panel meeting is scheduled for September 9, 1985. Those who desire further information on the study before that time should call the OTA Project Director, Dr. Fred B. Wood, at 202/226-2240.

Thank you very much for your continued interest in OTA. Please let me know if I can be of further assistance.

Sincerely,

Jack

John H. Gibbons

Attachment

cc: The Honorable William V. Roth, Jr.
The Honorable Albert Gore, Jr.

1985 MAY 16

WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT

OFFICE OF THE SECRETARY GENERAL

Palais Wilson
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Senator Charles McC. Mathias, Jr
United States Senate
Committee on Governmental Affairs
Subcommittee on
Governmental Efficiency and the
District of Columbia
Washington D.C. 20510
USA

9 May 1985

Dear Senator Mathias,

I am pleased to be able to respond to your letter of 25 March concerning "Global Foresight Capability" and will endeavour to deal briefly with the questions asked.

1. The World Commission on Environment and Development is a new and independent body created to look ahead at critical environment and development problems and propose better ways and means for the world community to address them. In its work, the Commission pays special attention to the United Nations' General Assembly resolution 38/161 which welcomes the establishment of the Commission, made a number of suggestions for its work, and provided for the report of the Commission to be submitted to the General Assembly of 1987.

1.1 More specifically, the Commission has been mandated to:

- re-examine the critical issues of environment and development and to formulate innovative, concrete and realistic action-proposals to deal with them;
- assess and propose new forms of international co-operation on environment and development that can break out of existing patterns and influence policies and events in the direction of needed changes;
- raise the level of understanding and commitment to action on the part of individuals, voluntary organizations, businesses, institutes and governments.

W0035B/bb

1.2 The Chairman of the Commission is Mrs Gro Harlem Brundtland, Leader of the Opposition, former Prime Minister and a former Minister of Environment of Norway. The Vice-Chairman is Dr Mansour Khalid, former Foreign Minister of the Sudan. There are altogether 22 Commissioners as shown on the attached list. They include prominent political figures and leaders in environment and development, 5 from Asia, 5 from Africa, 4 from Latin America, and 3 each from Western and Eastern Europe. They were selected by the Chairman and the Vice-Chairman, and are serving in a personal capacity.

1.3 The Commission will draw on the world's best minds to assist it perform its work in as open and visible a manner as possible. Its meetings are taking place in many different parts of the world to permit good regional access. It is calling on the world's media both to popularize contributions received and the Commission's own work and, wherever practical, to provoke and gather new ideas and to sound out public opinion.

1.4 Financing of the Commission is on the basis of voluntary contributions of funds and of services-in-kind from governments or other institutions and sources. All accounts are subject to external audit.

2. The state of governments' global models?

First I should note that the Commission has no "member governments": each Commissioner serves in an individual capacity. Nor has it examined this question. Speaking personally, however, I would doubt that the situation concerning the state of global models in general in the governments of western industrialized countries has changed since I oversaw the preparation of the report on "Economic and Ecological Interdependence" for the OECD in 1982. At that time we found that few countries had any such capacity nationally and that those that did faced serious difficulties. These included serious inconsistencies in the methods and systems employed by the various agencies in making projections; lack of co-ordination between agencies and, in some instances, limited resources.

3. Perceived level of interest by government ministers in global modelling.

I perceive that, with few exceptions, the top ministers and decision-makers of most governments have a very low interest in global modelling and view its usefulness as a decision-making tool with extreme scepticism.

W0035B/bb

4. Limitations of global models?

4.1 In my own view this scepticism is well founded, and for at least two reasons. The first is the models themselves. Clearly, there has been a great improvement over the past decade since as a deputy minister in the government of Canada my department undertook one of the first attempts to put together a macro urban impact model and the future looks promising. But global policy models have a long way to go before their results will inspire confidence.

4.2 The second is the inordinate difficulty to get the separate agencies of any government to accept common assumptions. Departments and agencies serve different constituencies and client groups. It is easy to hide bias that favours your client in apparently objective assumptions, so easy, in fact, that few agencies are prepared to give up the privilege of formulating and manipulating their own assumptions in the interests of improving the future performance of global models.

5. Level of Communication between and among nations on global models?

5.1 In the 1982 study referred to above, we found that, at the international level, there was no mechanism through which governments may co-operate in the testing, review and comparison of the methods, results and limitations of global modelling studies. It is doubtful that there has been any change since, which means that there is a great need for such a mechanism.

5.2 This is especially true perhaps in the environment and development field where there is a clear need to improve capacity within and among countries not only to analyse global environment and development issues but also to put it all together, to examine the interdependencies and to relate the parts to the whole. Beyond this there is also a need for a collective capacity to extract from such synthesis relevant conclusions that bear on policy action by governments.

I hope that the Commission will have an opportunity to examine some of these questions.

Yours sincerely,

Jim MacNeill
Secretary General

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[illegible] AND DEVELOPMENT

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WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT

OFFICE OF THE SECRETARY GENERAL

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WASHINGTON, D. C. 20006

May 15, 1985

The Honorable Charles McC. Mathias, Jr. and
The Honorable Robert T. Stafford
United States Senate Committee
on Governmental Affairs, Sub-Committee
on Governmental Efficiency and
the District of Columbia
Hart Senate Office Building, Room 442
Washington, DC 20510

Dear Senator Mathias and Senator Stafford:

Thank you for your letter of April 23, 1985 requesting information on the database and forecasts prepared by the Institute of International Finance. In response, I am pleased to enclose written testimony on the Institute's work in this area for the hearing record entitled, "Global Foresight Capability of the U.S. Government".

Yours sincerely,

Andre de Lattre,
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U.S. SENATE GOVERNMENTAL AFFAIRS SUB-COMMITTEE
ON
GOVERNMENTAL EFFICIENCY AND THE DISTRICT OF COLUMBIA

May 15, 1985

Global Foresight Capability of the U.S. Government

Note by the Institute of International Finance

The Institute of International Finance, which was established two years ago, provides information and reports on borrowing countries to its Members. These include more than 180 of the world's major commercial banks from 37 countries. They account for more than 80 percent of total international bank lending to developing countries. A number of official international lenders are also Associate Members of the Institute.

The Institute provides Members with a database for some 40 borrowing countries. The database includes all the main domestic economic aggregates as well as information on trade and the balance of payments. A particular focus is on borrowing countries' external liabilities to different international creditors, including the IMF, the World Bank, governments, commercial banks and other private lenders.

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The Institute's database covers the main budgetary and monetary policy indicators in individual countries. It provides information on structural factors such as the commodity composition and directors of trade, as well as the main categories of domestic output. It also includes indicators on savings and investment behavior, together with employment and per capita income.

The database is compiled from a wide variety of international sources but more especially from individual countries' own national sources in the course of country missions by IIF Staff. The Institute's database provides a comprehensive and consistent framework within which borrowing countries' performance, policies and prospects can be analysed. It is of course, tailored particulary to the needs of commercial banks and other international lenders.

The Institute's Staff uses the database to construct economic forecasts for borrowing countries typically for 12-18 months ahead. These forecasts take as their starting point a consistent view about the world economy. The forecasts for the individual countries are then based on simplified computer models, together with the judgments of the Institute's country analysts. Periodically, the Institute Staff also constructs medium-term scenarios to examine the prospects for five years ahead at least for the major borrowing countries.

The database and projections are available to Members via a world-wide computer network. Members of the Institute are available to answer queries from other Members either directly or through an electronic mailbox system. An advisory committee of senior economists from Member banks meets with Institute Staff periodically to discuss the database and other economic work. Economists from Member banks are also seconded to the Institute.

The database is supplemented by detailed country reports written by Institute Staff after missions to borrowing countries. The Institute has conducted some 20 missions in the past year or so. Staff members are joined on these missions by representatives of Member banks. Missions typically meet with senior officials from the borrowing countries' governments and central banks.

The Institute's database, projections and reports provide Member banks and other lenders with information to contribute to their own decision-making on lending opportunities and credit risks. The Institute's material is also used more generally for economic briefing.

The Institute — in common with other analysts — is well aware of the deficiencies of data in this area. These shortcomings cover not only incomplete information from borrowing countries in some cases but also lack of data from the creditor side — at least in some cases on the activities of official creditors. The Institute is aware of at least some efforts being made to remedy these deficiencies but it must be hoped that these can be pursued vigorously if adequate data are to be available to all participants for the proper and efficient working of the international financial system.

The Institute is also aware of the problems of constructing country projections where the underlying economic relationships are difficult to identify and often not stable. The Institute's Staff, therefore relies on detailed country knowledge and close monitoring of current developments and policies as well as more formal economic techniques.

The Institute has not been in existence long enough to test its methods fully but it has been encouraged by the reception by its Members and the co-operative effort with them to develop an overall system that effectively meets the needs of commercial banks and other international lenders.

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STATEMENT OF THOMAS B. STOEL, JR.
DIRECTOR, NRDC INTERNATIONAL PROGRAM
FOR JOINT HEARINGS ON GLOBAL FORESIGHT
BY THE
SENATE ENVIRONMENTAL AND PUBLIC WORKS COMMITTEE
AND THE
SUBCOMMITTEE ON GOVERNMENTAL EFFICIENCY OF THE
SENATE GOVERNMENTAL AFFAIRS COMMITTEE

April 30, 1985

Thank you for permitting me to submit a statement for the record of these important hearings. I am Director of the International Program of the Natural Resources Defense Council (NRDC) and President of the Global Tomorrow Coalition. NRDC is an environmental protection organization with some 45,000 members in every state and many foreign countries. The Global Tomorrow Coalition is a coalition of more than 70 U.S. nongovernmental organizations concerned about global population, resource, and environmental problems. Together, these organizations have more than 6,000,000 individual members. Although every organizational member of the Coalition is interested in the subject of these hearings, I will speak for the Coalition in only part of my statement.

Our Nation faces no greater problem, and none which is less recognized, than the inability of our Federal Government to make

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accurate, integrated projections of global trends and to make the data and their implications available to the President, the Congress, and other key decisionmakers. The initiative of Senators Mathias and Stafford on holding these hearings is to be highly commended.

These trends have serious implications for the United States. Americans obviously should be concerned about the imminent exhaustion of petroleum supplies, growing concentrations of toxic substances with adverse health effects, acid rain, and the agricultural impacts of atmospheric warming and depletion of the stratospheric ozone layer.

It may appear that other trends -- growing desertification and other forms of soil erosion, increasing destruction of tropical forest, accelerating extinctions of wildlife species -- have little to do with us. Their immediate impacts are mainly in the Third World, and seem far removed from American life. Yet we must be concerned about these problems as well.

One major connection is economic. Most commodities we use are traded on world markets, and the prices we pay or receive are world prices. We import from and export to other nations on a larger scale than ever before. Developing countries acount for almost 40% of U.S. exports and imports. Already we react strongly when Brazil or Mexico can't pay its debts. It is clear that these nations with fast-growing populations will consume an increasing share of the world's economic wealth. The future of U.S. industry may well depend on finding markets there. Massive environmental degradation can undermine their prospects for economic growth, as is happening in Haiti and parts of Africa.

The environmental dimension of interdependence is at least as important. The earth's life-support system, the biosphere, is interconnected by complex biological and geochemical processes. Serious disruptions anywhere are likely to affect us all. Some major problems -- managing the oceans, halting ozone depletion, preventing carbon dioxide buildup, controlling trade in hazardous materials, harmonizing regulation of toxic substances -- are inherently international, and international cooperation is needed to solve them.

The environmental and economic spheres are interlinked. Crippling of agriculture in drought-stricken areas of Africa already has produced proposals for a billion dollars in U.S. food aid, and this may be only the beginning. Our industry, agriculture, and medicine all depend on genetic materials from the tropics for which the outlook is precarious.

A third area of interdependence is national security. A realistic view of our long-term security interests must include protection of our agriculture, forestry, and other resource-based industries from disruption due to acid rain, carbon dioxide buildup, loss of genetic materials, and other environmental effects. Environmental problems also threaten our traditional security interests. The last 40 years have seen a growing national security relationship between the United States and developing countries. We have fought two major wars in developing nations: Korea and Viet Nam. We perceive a U.S. interest in the security of nations as disparate as El Salvador, the Philippines, Saudi Arabia, and Kenya. In its 1984 report, the Kissinger Commission found the U.S. interest in Central America strong enough to warrant an $8 billion foreign assistance program directed at that small region. If developing nations suffer from massive, destabilizing environmental degradation, our security interests surely will be harmed.

These effects of global trends upon our welfare make it crucially important that our Nation possess the capacity to understand and take account of these trends. Yet the Global 2000 Report documents that our ability to do so is woefully inadequate, and that there are serious deficiencies in the data base, in the ability of our Government to make projections, and in the mechanisms for making decisionmakers aware of the implications.

It follows that the United States should act as swiftly as possible to improve its ability to project global trends and to improve the data base. It is incredible that this Nation, with the most sophisticated data processing systems in the world, a high degree of computer modelling expertise, unexcelled policy analysis capability, and an awareness of the need to anticipate and respond to long-term problems, has reached the last decade of the twentieth century with no institutional entity at the highest level of government charged with utilizing these capabilities to analyze global issues and trends.

The Global Tomorrow Coalition has more than 70 member organizations ranging from the Turfts University to the National Audubon Society to Zero Population Growth to my own Natural

Resources Defense Council. The Coalition requires the unanimous consent of all its members before it can take a public position. The first, and thus far the only, issue on which it has done so is the question of U.S. foresight capacity. The Coalition's statement reads as follows:

> Current trends of rapid population growth, wasteful resources consumption, and abuse of the environment endanger the global base for all human activity. The United States is poorly equipped to identify and project the interactions of these trends over time, and is therefore unprepared to choose rationally among long-range policies to achieve a more desirable future.
>
> We believe this situation constitutes nothing less than a threat to U.S. national security and to the future well-being of the American people. Our national foresight capability must be improved by efforts in both the public and private sectors. As first steps in this direction, we recommend the following actions:
>
> (1) establish in the Executive Office of the President an improved capacity to coordinate and analyze data collected by federal agencies and other pertinent sources on the long-term interactions of trends in population, resources, and environment - and their relationship to social and economic development - and to provide information relevant to current policy decisions responsive to the needs of the national and global future;
>
> (2) encourage and facilitate widespread public participation in the discussion of choices for a desirable national future; and
>
> (3) invite other nations to expand their own foresight capability and share in an international exchange of relevant data and information.

It is time for action. The Congress should enact legislation to establish the kind of foresight capacity called for in the Coalition's statement.

GLOBAL ENVIRONMENTAL PRINCIPLES

(Presented by the United States to the United Nations
Environmental Program Session,
Nairobi, Kenya, May 1982)

- A healthy environment is fundamental to the well-being of mankind.

- Economic growth and social progress are necessary conditions for effective implementation of policies which will protect the global environment and promote wise use of the earth's natural resource base.

- Environmental policy should be based on the interests of present and future generations. The most successful policies are those which promote liberty and individual rights, as well as protection of the physical environment.

- Nations should pursue economic development in furtherance of the security and well-being of their citizens in a manner which is sensitive to environmental concerns. Due respect should be given to different approaches which various nations may adopt to integrate environmental considerations into development strategies based on their particular national values and priorities.

- Careful stewardship of the earth's natural resources can contribute significantly to sound economic development. Individual ownership of property, free and well-developed markets in products and capital are powerful incentives for resource conservation. These institutions best promote the use of renewable resources and the development of substitutes for non-renewable resources, ensuring continued resource availability and environmental quality.

- When environmental problems extend beyond the boundaries of any one nation, all affected nations should participate in investigating the nature of the problem, understanding its implications, and developing cost-effective responses.

- Governments, like individuals, should act so as to minimize environmental degradation. Decisions on environmental policies and programs should take into account the concerns of those closest to the problems and most directly affected.

- Increased scientific understanding of environmental problems, and improved methods of forecasting environmental conditions are needed to address environmental issues in an effective and efficient manner. Ultimately, resolution of environmental problems which are global in nature will be determined by the quality and credibility of our scientific and technical knowledge as well as by the degree of cooperation among nations including the effective involvement of private sector institutions.

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April 12, 1985

2 councils created to advise Reagan

By The Washington Post

SANTA BARBARA, Calif. — President Reagan on Thursday announced a major overhaul of the White House domestic policy-making apparatus, creating two major councils for handling domestic and economic affairs.

The new arrangement puts the imprint of Chief of Staff Donald Regan on the White House's policy machinery, but also gives prominent roles to two former White House aides, Attorney General Edwin Meese and Treasury Secretary James Baker.

The new Domestic Policy Council and Economic Policy Council will consolidate the functions of seven Cabinet councils and the Senior Interagency Group on International Economic Policy. The new councils appear to be closer to the mold of the White House organizations used by recent presidents.

Although Reagan will chair both councils, Meese will head the domestic policy council in his absence and Baker, the economic policy council. Meese formerly was White House counselor and Baker was chief of staff.

White House spokesman Larry Speakes, who disclosed the overhaul in a statement read while Reagan was vacationing at his ranch near here, said, "I don't see any winners or losers here."

But the plan reflects the management style of Regan, who switched jobs with Baker earlier this year and has sought to impose a more disciplined, corporate structure on the White House than existed under Baker, Meese and outgoing deputy chief of staff Michael Deaver.

Regan conceived the new plan, and will decide which issues will be handled by each council, Speakes said. One of Regan's deputies, Alfred Kingon, the White House Cabinet secretary, will receive the recommendations of the councils.

Speakes said Reagan was not dissatisfied with the previous arrangement, but critics of the Cabinet councils have said they were only partially effective.

The new councils may be more influential than the old ones. Reagan said Thursday that along with the National Security Council, they will serve as "the primary channels for advising me on policy matters."

Speakes said the Office of Policy Development, which used to include the Cabinet councils, will continue to function under John A. Svahn as a source of new policy ideas and initiatives.

Speakes said the formal trio of economic policy-makers — the Treasury secretary, the OMB director and the chairman of the CEA — will continue to meet and advise Reagan.

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14 May 1982

Improving the Government's Capacity to Analyze and Predict Conditions and Trends of Global Population, Resources, and Environment

by

Gerald O. Barney

A report prepared for the
Council on Environmental Quality
under Contract EQ 2003

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Executive Summary

The purpose of the Global 2000 study was not to provide the definitive study of the future, but rather to establish a foundation for ongoing foresight analysis within the Federal Government. The study identified the best models, data and professional staff within the government, and through the study process established a foundation for the government's foresight analysis.

The findings of the Global 2000 study are not particularly startling. Assuming a continuation of present policies, rapid technological advance, continued operation of the market system, and no wars or major economic disruptions, the study found that the population growth would continue well into the twenty-first century; that there would be much further economic growth; that the gap between the richest and the poorest would widen; that no quick, easy solutions to the world's energy problems are in sight; that more food will be produced, but at higher cost; that in a few parts of the world, per capita food consumption may decline; that by the turn of the century several environmental problems -- especially soil erosion, loss of genetic resources and certain atmospheric problems -- are likely to be more severe than today; and that in some parts of the world, populations are putting sufficient pressure on the land to erode and reduce the carrying capacity of the land. The study concludes that the situation is by no means hopeless, but that the problems cannot be solved by any one nation alone and that concerted and timely action is needed.

Population, resource and environmental problems are becoming issues of national security for virtually every nation. The time has passed when any nation can think of its future security and welfare independent of developments affecting population, resources and the environment. The time has also passed when any nation can think of its future in these regards independent of what is happening in the rest of the world.

The issues of population, resources and environment are becoming so interrelated and complex that computers are needed to understand the implications of alternative policies and programs. Unfortunately, careful study of the best global models now available in the U.S. Government shows that the Executive Agencies of the U.S. Government are not now capable of presenting the President with internally consistent projections of world trends in population, resources and the environment for the next two decades.

The extent of the problems with the government's models is reflected in an experience early in the development of _The Global 2000 Report_. When the senior professional persons responsible for the long-term global analysis in each of the fourteen participating agencies came together for a meeting, not one had ever met any of the others. In general it was found that the models and data employed by the various agencies are shot full of internal contradictions and inconsistencies, the overall consequence of which is that the projections and policy analyses made by the agencies almost certainly underestimate the seriousness of the long-term problems facing this nation and the world. In short, the analytical foundations of the Government's policy analysis and foresight are seriously flawed.

One basic problem is that the government's institutional structures were designed before there was need for computer-assisted analysis of complex issues. As they have evolved, the government's agencies now have a hidden layer of decision-makers -- computer programmers and modelers. These decision-makers are, by and large, very skilled professionals, but they are often working in institutional circumstances which prevent them taking into account all the factors they know should be taken into account. Furthermore, the assumptions that they make have a profound influence on the range of policy options considered by senior government officials, and their assumptions are not well documented, are not understood by senior government officials, and are not available for peer review and comment.

To improve the situation, increased coordination of models development and documentation is needed by the Executive Office of the President. The models and analysis, however, should remain within the individual agencies, close to the constituencies that understand the issues involved. The nation does not need an office of global planning in the White House basement.

Changes are also needed in the Congress. Committees responsible for foresight would be helpful, as would strengthening of the foresight responsibilities of the Office of Technology Assessment, the Congressional Research Service, and the General Accounting Office.

Private sector participation is also needed. To compete effectively in world markets, the private sector needs a highly professional government, capable of formulating wise, long-term policies. Short of this, countries like Japan will continue to have competitive advantage. Private sector participation in the formulation, improvement and maintenance of policy should be encouraged.

The Global 2000 Reports

by Gerald O. Barney Ph.D.*

November 8, 1984

Prepared for the *Encyclopedia of Peace*, to be published in 1985 by the Institute of International Peace Studies, Seoul, Korea, (Kyung Hee Univ. Press).

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* Dr. Barney directed the preparation of the U.S. Government's *Global 2000 Report to the President*. He now heads the consulting firm, Gerald O. Barney and Associates, Inc., and an associated non-profit organization, The Global Studies Center, Inc. Both organizations are concerned with research on global issues of peace, security, and sustainability.

In 1977 President Jimmy Carter sent an environmental message to the United States Congress in which he wrote:

> Environmental problems do not stop at national boundaries. In the past decade, we and other nations have come to recognize the urgency of international efforts to protect our common environment.
>
> As part of this process, I am directing the Council on Environmental Quality and the Department of State, working in cooperation with the Environmental Protection Agency, the National Science Foundation, the National Oceanic and Atmospheric Administration, and other appropriate agencies, to make a one-year study of the probable changes in the world's population, natural resources, and environment through the end of the century. This study will serve as the foundation of our longer-term planning.[1]

To build the foundation called for by the President, about 30 of the U.S. Government's top professional experts drew together the best data and models available anywhere in the government.[2] Approximately one million dollars was spent on the work. There were also certain political problems encountered in releasing the report.[3] The resulting report, The Global 2000 Report to the President,[4] was published in the fall of 1980. The primary parts of the report are available in English,[5] German,[6] Japanese,[7] Spanish,[8] Chinese,[9] Italian,[10] and French.[11]

The primary conclusions of the report are as follows:

> If the present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources, and environment are clearly visible ahead. Despite greater material output, the world's people will be poorer in many ways than they are today.
>
> For hundreds of millions of the desperately poor, the outlook for food and other necessities of life will be no better. For many it will be worse. Barring revolutionary advances in technology, life for most people on earth will be more precarious in 2000 than it is now -- unless the nations of the world act decisively to alter current trends.
>
> This, in essence, is the picture emerging from the U.S. Government's projections of probable changes in world population, resources, and environment by the end of the century, as presented in the Global 2000 Study. They do not predict what will occur. Rather, they depict conditions that are likely to develop if there are no changes in public policies, institutions, or rates of technological advance, and if there are no wars or other major disruptions. A keener awareness of the nature of the current trends, however, may induce changes

that will alter these trends and the projected outcome....

The needed changes go far beyond the capability and responsibility of this or any other single nation. An era of unprecedented cooperation and commitment is essential....

To meet the challenges described in this Study, the United States must improve its ability to identify emerging problems and assess alternative responses. In using and evaluating the Government's present capability for long-term global analysis, the Study found serious inconsistencies in the methods and assumptions employed by the various agencies in making their projections. The Study itself made a start toward resolving theses inadequacies. It represents the Government's first attempt to produce an inter-related set of population, resource, and environmental projections, and it has brought forth the most consistent set of global projections yet achieved by U.S. agencies. Nevertheless, the projections still contain serious gaps and contradictions that must be corrected if the Government's analytic capability is to be improved. It must be acknowledged that at present the Federal agencies are not always capable of providing projections of the quality needed for

> long-term policy decisions....
>
> With its limitations and rough approximations, the Global 2000 Study may be seen as no more than a reconnaissance of the future; nonetheless its conclusions are reinforced by similar findings of other recent global studies.... All these studies are in general agreement on the nature of the problems and on the threats they pose to the future welfare of humankind. The available evidence leaves no doubt that the world -- including this Nation -- faces enormous, urgent, and complex problems in the decades immediately ahead. Prompt and vigorous changes in public policy around the world are needed to avoid or minimize these problems before they become unmanagageable. Long lead times are required for effective action. If decisions are delayed until the problems become worse, options for effective actions will be severely reduced.

At the time of the release of the report, Present Carter appointed a five-member task force to make recommendations on the issues addressed by the report. Unfortunately the government's experts, who wrote the Global 2000 Report, were not permitted to participate significantly in the preparation of the recommendations, and the resulting document, Global Future -- Time to Act[12] became so highly politicized that three of the five members of the President's task force refused to sign it when it appeared in the final weeks of the Carter Administration.

The peace and security of nations around the world are very much dependent on resolving the issues discussed in the Global 2000 Report. It is increasingly apparent that "prompt an vigorous changes in public policy around the world" are needed if the problems associated with these issues are not be become "unmanageable."

Responses to the report have varied from country to country. In the United States, the government changed shortly after the publication of the Global 2000 Report. The Reagan administration limited its follow-up to an analysis of the uses that private business make of global data.[13] A few hearings were held in the Congress, and the Office of Technology Assessment prepared a thoughtful analysis of the use of global analysis and its relevance to public policy.[14] Most of the U.S. follow-up work, however, was done outside of government by private, independent organizations. The Global Tomorrow Coalition[15] was founded to bring together approximately one hundred non-governmental groups to address global issues. The Heritage Foundation[16] critised the work. The Year 2000 Committee[17] lobbied Congress for the establishment of an Office of Foresight in the executive branch. The Creative Initiative Foundation[18] produced several educational films on global issues. Zero Population Growth[19] prepared an extensive package of educational materials.

The report has attracted much attention in the Federal Republic of Germany where there have been several discussions of the report in the Bundestag. The Bundestag commissioned a detailed review[20] by German government ministries and

German scientific institutions. The review concludes that, "the basic thesis of the American global analysis is shared in principle even by critics" and argues that the global tendencies presented in the U.S. report "represent key problems for the future of humanity." It observes that a widening gap between the rich and poor "can lead to great tensions in the world."

The German review headed by Andreas von Bülow, Minister of Science and Technology, notes that the problems facing the world cannot be solved "through German efforts alone," and that cooperation among nations will be required. In pursuit of the needed cooperation the Germans participated in an international consultation in late 1980 about the Global 2000 Report. This consultative effort came to naught, Bonn reported, because the international consultation on the Global 2000 Report "is no longer sought" by the U.S. Government.

In Italy, the Italian Senate held a full day of hearings on the U.S. Global 2000 Report. The transcript of these hearings was published as an Italian Senate report, Previsioni Circa lo Sviluppo nei Prossimi Decenni.[21]

The Canadian government commissioned a study of the implications of the Global 2000 Report for the future of Canada. The resulting book was published under the title Global 2000: Implications for Canada.[22]

The government of the People's Republic of China initiated a China 2000 study for Premier Zhao Ziyang.[23] The China 2000 study is modeled in part on the Global 2000 study. It is an extensive report of approximately 300 pages that has involved hundreds of institutions throughout China.

National year 2000 studies that are patterned in part on the Global 2000 Report are in progress in Iceland,[24] Mexico,[25] and South Korea.[26] Similiar studies are under consideration for Brazil, Taiwan, and Sengal.

The inquiries and studies stimulated by the Global 2000 Report continue, and will receive support and encouragement in the future. The Rockefeller Brother Fund has provided initial funding to a new non-profit, non-governmental organization, The Global Studies Center, Inc. to provide technican assistance and training for such efforts.[27]

A prerequisite of a peaceful world is a world secure in health, prosperity and justice. The Global 2000 studies are providing new tools for understanding how the security of all nations -- and ultimately the peace of the world -- can be increased.

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5. In addition to the U.S. Government edition listed above (reference 4) the report is available from Pergaman Press, Penguin, and Blue Angel.

6. Published by Zweitausendeins, Postfach, D-6000, Frankfurt am Main 61, Federal Republic of Germany.

7. Available from the Japan Productivity Center, 3-1-1 Shibuya-ku, Shibuya-ku, Tokyo, Japan.

8. Published by Editorial Tecnos, GSR International, O'Donnell, 27, Madrid 9, Spain.

9. Published by the Institute for Technological Information of China, P.O. Box 640, Beijing, China.

10. Included in an appendix to: *Prevision; Circa lo Sviluppo nei Prossimi Decenni*, Integrazioni Conoscitive al Dialogo Parlamentare, 3, Rome: Senate Della Republica, 25 Feb. 1981.

11. Available in photocopies from Barney and Associates, Inc., 1611 North Kent Street, Suite 600, Arlington, VA 22209, USA.

12. Gus Speth, Task Force Chairman, *Global Future: Time to Act*, Washington: Government Printing Office, January 1981.

13. Russell E. Train, *Corporate Use of Information Regarding Natural Resources and Environmental Quality*, Washington: World Wildlife Fund, May 16, 1984.

14. William Mills, Project Director, *Global Models, World Futures, and Public Policy: A Critique*, OTA-R-165, Washington: Government Printing Office, April 1982.

15. For information, write Global Tomorrow Coalition, 1325 G Street N.W., Washington, DC 20005, U.S.A.

16. For information contact the Heritage Foundation, 513 C Street, N.E., Washington DC 20002, U.S.A. Also see H. Kahn and J. Simon, *The Resourceful Earth*, Oxford: Basil Blackwell, 1984.

17. For information, write Year 2000 Committee, 1601 Connecticut Avenue, N.W., Washington DC 20009, U.S.A.

18. For information, write Creative Initiative Foundation, 222 High Street, Palo Alto, California 94301, U.S.A.

19. But information on this education package, write Zero Population Growth, 1346 Connecticut Avenue, N.W., Washington DC 20036, U.S.A.

20. *Bericht der Bundesregierung zu "Global 2000,"* Bonn: Der Bundesminister für Forschung und Technologie, März 1982.

21. *Previsioni Circa lo Sviluppo nei Prossimi Decenni*, op. cit.

22. G. O. Barney, P. H. Freeman, and C. A. Ulinski, *Global 2000: Implications for Canada*, Oxford, Pergamon, 1981.

23. For information, contact Mr. Lin Zixin, Director, Institute for Technological Information of China, P. O. Box 640, Beijing, China.

24. Contact: Steingrimur Hermannsson, Prime Minister, Arnarhvoli, Reykjavik, Iceland.

25. Contact: Antonio Alonso Concheiro, Director General, Fundacion Javier Barros Sierra, a.c., Carretera al Ajusco S/N Tlalpan 140000 D.F. APDO, Postal 20061, 01000 Mexico D.F. Mexico.

26. Contact: Mr. Lee Sang Tae, Director, Overall Planning Division, Economic Planning Bureau, Economic Planning Board, Seoul, Korea.

27. For information write: Global Research and Training Center, 1611 North Kent Street, Arlington, VA 22209, U.S.A.

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October 17, 1983

Rural Development and Global Trends: Perspectives for the 1990-2010 Period

A Report with Suggestions for a Research Agenda

Gerald O. Barney and Jennifer Robinson

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Executive Summary

As one looks ahead to the period 1990-2010, there are a number of ideas and developments to be expected that will reshape present thinking on rural development.

* The annual increment to the world's population will still be increasing. Population growth rates in many of the poorest countries are expected still to be increasing in 2000.
* The industrial world is still highly dependent on petroleum. Petroleum production worldwide will peak before 2000. No abundant, clean and inexpensive energy source is within sight. The Department of Energy projects petroleum prices by 2000 to reach 4 to 8 times the price of petroleum during the period of industrialization in the western nations. As a result, building energy intensive industrial economies with low-priced petroleum may no longer be an option for the developing countries.
* The world food prospects are not good. The technology is available to produce much more food, but energy-intensive production and distribution make the food so expensive that those most in need cannot afford it.
* The world economic outlook for the next several years is not bright. Even if the recovery in the industrialized countries is sustained, the rapid economic growth of the 1960s will not return. The poorest developing countries and those with large debts face the prospect of declining employment and declining GNP/per capita.

- Rural development will be made more difficult if economic growth does not permit further expansion of job opportunities in urban areas in developing countries. Rural areas benefit from the urban areas' capacity to absorb surplus, low-skilled labor and to purchase rural produce.
- There are serious rural development difficulties to be faced on all three developing continents. The prospects in Africa are probably worst. In Africa one can expect severe fuelwood shortages, extremely severe water problems, severe overgrazing, extensive desertification, and food shortages so severe that adults will not be able to carry on normal work functions or maintain good health, and children will not achieve their normal physical and mental development. Together, these conditions will maintain the social and economic circumstances in which people want large numbers of children. The vicious circle of population pressure reducing the carrying capacity of the land and at the same time making population stabilization more difficult is probably the most difficult of future rural development.

Twenty research possibilities are presented at the conclusion of this paper. Perhaps the most important research possibilities are:

- Defining what "development" means for the poorest rural areas in an era when energy prices will be the equivalent of $40 - $80/bbl, or higher.

- Examining the "vicious circle" rural-development problem in its totality.
- Reappraising and broadening the concept of national security to include consideration of the implications that deepened rural poverty and reduced food availability could have in the decades ahead.
- Reassessment of the nation's R&D priorities in terms of their potential contributions to rural development.

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CONGRESS'S FORESIGHT NEEDS TO THE YEAR 2000 AND THE CAPACITY OF ITS SUPPORT AGENCIES TO ASSIST IN MEETING THOSE NEEDS

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CONGRESS'S FORESIGHT NEEDS TO THE YEAR 2000 AND THE CAPACITY OF ITS SUPPORT AGENCIES TO ASSIST IN MEETING THOSE NEEDS

Conventional wisdom holds that Congress does not sufficiently think in long enough terms when confronting the needs and problems facing the Nation. It is commonplace, because of the House's election cycle, to assert that Congress is prone to policy fixation on a 2 year cycle and allows itself to become concentrated on the immediate to the detriment of the long-range. There is evidence, however, that this conventional wisdom mischaracterizes the Congress's intentions and attention to the long-range problems and needs of the Nation. For example, even the casual reader of the Congressional Record will find in its Daily Digest an abundance of hearings listed that indicate and document Congress's efforts to take 5, 10, and 20 year, or even longer, perspectives on issues that could become important to the Nation.

In a democracy Members must respond to pressing needs and the views of their constituents; they also have to recognize their responsibility to anticipate developments and events that will affect the future interests and lives of their constituents, and the directions in which the country may head or needs to move.

Foresight aims to provide Members with information and analysis they can use to anticipate opportunities and problems. Acting on anticipated problems entails special benefits and risks. The benefits derive from the possibility that early action can reduce the social, political, and economic costs of congressional action. The risks result from uncertainties about what conditions will prevail in the future and what the outcome of proposed anticipatory action will be on the unknown future.

While some analysts have applied the foresight perspective to the environment, industrialization, war and peace, introduction of high technology and other large issue areas, this approach is applicable to almost any issue Congress might consider, provided there are:

- a need to prepare for possible problems and opportunities;
- actions the Congress might take to prepare for or possibly modify emerging circumstances or conditions;
- an adequate understanding of current conditions; and
- information and analytical methods that will permit trends to be projected as a range of plausible futures.

FORESIGHT RELIES ON EXISTING NATURAL AND SOCIAL SCIENCE METHODS

While the casual observer of foresight procedures may focus on the more esoteric futures' research techniques, it can be argued that foresight activities mainly rely on the established disciplines and methods of the social and natural sciences. The distinguishing feature of foresight activity is the application of a longer term or "futures" perspective to the issues which Congress confronts in deliberating policies that have or will have an impact on our lives. Frequently, these impacts may occur over a period of decades.

In its statement of editorial policy, the Futures Research Quarterly of the World Future Society points out:

> Futures research encompasses both an evolving philosophy and a range of techniques. Its primary objective is to assist decision-makers to understand better the potential

> consequences of present and future decisions by developing images of alternative futures. It has strong and sound historical origins in sociology, more recently in political science, and in the other social sciences. It has independent origins also in corporate and institutional planning, in strategic and long-range planning, and has significant contemporary roots in government, particularly in national security. Successful practice of futures research requires contributions both from established academic disciplines and from such cross-disciplinary fields as technology assessment, policy analysis, operations research, issues management and many more.

Aspects of Foresight

All foresight activities aim ultimately to identify opportunities for action today involving potential future problems, developments, trends, and situations. Taking current action based on systematic and disciplined analysis can reduce the costs, or increase the benefits, of Government programs, activities, and policies needed to address identified current and future issues.

Wayne Brucher, a futures methodologist, has noted--probably correctly--that futures research is not a collection of techniques so much as a perspective that is composed of many simultaneous activities. He has identified eight of them as important:

- using perspectives from many disciplines in a unified analysis;
- relying both on objective data and subjective insights;
- analyzing the causal relationships among different emerging trends and events;
- adopting an appropriate strategic time horizon;
- dealing explicitly with uncertainty;
- melding exploratory and normative perspectives;
- focusing on policy choices;

- emphasizing process as much as product, i.e., recognizing that the analytic process must be reiterated in order to adjust for changing circumstances and additional, relevant information.

These general principles underpin the conduct of foresight activities in the Congress as well as those done in the executive branch and the private sector.

CONGRESS'S FORESIGHT NEEDS

It is probably correct that Congress has engaged in thinking about the future of the Nation since the very beginning of the Republic. Indeed, it can be reasonably argued that this activity is inherent in the very nature of the legislative responsibilities of the Congress. Since the mid-1970s, however, Congress has specifically recognized that foresight activities should be a principal function of its committees. In 1974, the House of Representatives adopted in its Rules a provision requiring its committees to engage in foresight in order to systematically identify, examine and analyze emerging trends that have an impact on the Nation. This further requires House committees to think about developing and establishing policies to address needs or problems arising from such trends. Subsequently, in 1976-77, the Commission on the Operations of the Senate and the Senate Select Committee on Committees, operating independently but in coordination, recommended that Senate committees also engage in systematic foresight efforts. So far, this recommendation has not been incorporated in the Rules of the Senate.

Rationale and Requirements for Congressional Use of Foresight

Each actor in the legislative branch--Members, committees, and leadership alike--is continually faced with the need to anticipate the consequences of legislative action. Members, committees, and the whole Congress take action now with the expectation that certain results will occur. Most legislation is primarily directed to affecting current circumstances or events that will occur within a few months, days, or weeks. Nevertheless, the legislation can have unforeseen longer-range impacts on various constituencies and the Nation.

At times, differences in individual Member's expectations of the impact of a bill may facilitate agreement. This happens when Members vote for the same measure to achieve different goals. Thus, action may be facilitated by an inability to agree upon its impact. On the other hand, when Members cannot understand the effect of legislation, it is difficult to obtain agreement to change the law.

In order to consider the impact of legislation on future circumstances, Congress needs information and analysis that relate current trends to future needs.

Informed foresight activities begin with a study of past and current trends and their interrelationships. As pointed out above, most foresight studies rest upon the established methods of social and natural science. Uncertainties about trends result in part from gaps in the information that can be or has been collected and analyzed. Each scientific discipline recognizes the importance and limiting impact of these gaps. Yet, in many situations where there are such gaps, Congress must act. Foresight helps to make the gaps explicit and provides information to deal with them.

Uncertainty about the future partially results from limited understanding of the outcomes of current policies and situations.

— Some trends are the extension and extrapolation of current activities and conditions. For example, 30 years ago a maximum limit was set on the number of 30-year-olds who might be living in the world today.

- By contrast, some trends are subject to the slowly developing influences of subsequent events. For example, the practice of medicine 20 years from today will, among other things, be limited by decisions made by pre-medical and medical education programs over the next 10 years.
- Yet a third group of trends are subject to short-term variation. The unemployment rate, for example, responds to changes in the economy. Also, the public's views of the most important problems facing the Nation shift in response to current events.

Foresight for Congress begins by studying the relationship among trends that are capable of extrapolation and those that are not.

If Members had good information about those trends that can be extrapolated, and the underlying relationships among them and the objectives of public policy, they could formulate legislation that would better anticipate the impact of current trends on society. This would increase the chance that legislation will better meet desired goals and objectives.

A major obstacle to achieving this goal is the lack of recognized procedures for estimating the type, amount, and consequences of uncertainty in an anlytical conclusion. These inferences, whether formally stated, empirically derived, or assumed, are required before Members can try to anticipate the future outcome of their activities.

Statistical procedures for dealing with uncertainty largely focus on sampling, measurement, and inferential procedures regarding the present or past. As such, they provide a starting point for predicting the uncertainty in foresight. Another source of uncertainty can be the conceptual framework, values and assumptions of analysts. Good foresight analysis requires that these assumptions be specifically stated and their sensitivity to changes in expected conditions made explicit.

The interpretation of trends and their application to legislative alternatives requires a solid factual grounding if it is to provide a reliable component of Member's decisions. To extrapolate the consequences of policy alternatives, analysts use their empathetic skills to gain insights that help identify and describe possible results. Political and social leaders then use imagination and vision to derive strategies that will meet emerging challenges.

ROLE OF DIFFERING PERSPECTIVES

Most research that can be used to anticipate the future rests upon the values, assumptions and agenda incorporated in the researcher's design. To the extent that these values are articulated and reflect the agenda of an organization, the resulting research will be useful.

Congress does not have one agenda, but responds to many competing and often conflicting agendas. Different Members, who represent diverse constituencies, may reflect alternative values. Congress rarely speaks with one mind. It is not a highly hierarchial organization in which the views of the leadership are reflected in the views of all the Members. Rather, it is organized to reflect the variety and the diversity of a democratic society.

Consequently, the organization of Congress and the different points of view represented within it make it essential that foresight analyses include an explicit statement of values and assumptions. Congress requires analyses that are sensitive to the relationship between the assumptions made and the usefulness of the results. Congress formulates legislation through the processes of accommodation. What results rarely totally satisfy any one set of advocates, but they do reflect the consensus obtainable at the time the decision is reached.

OBTAINING FORESIGHT ANALYSIS TO MEET THE NEEDS OF CONGRESS

In seeking the analysis it requires in order to systematically examine emerging issues, Congress has a number of sources to which it may turn. Within the private sector, there are a wide variety of research organizations and societies that dedicate themselves to foresight activities and whose findings are available and can be referred to. Congress can also draw upon the body of research that flows from scholars in universities, colleges, and private research institutes, which, while not labeled as foresight or reliant on techniques associated with futures research, can provide valuable information and analysis to assist the Congress in policy deliberations.

In addition, Congress has available to it studies and analyses of the executive branch, congressional committee staff, legislative research staff of Members, the Congressional Clearinghouse on the Future, and study papers prepared by numerous issue-related informal caucuses.

Four agencies, that are by law directed to assist the Congress, are also available to provide information, research, and analysis on critical national and global trends and issues that require congressional awareness, consideration, and possibly legislative action. These agencies are the Congressional Budget Office, the Congressional Research Service, the General Accounting Office, and the Office of Technology Assessment. Assisting Congress with its foresight needs, however, represents only a portion of the responsibilities of each of these agencies. In assessing each agencies' capability to help Congress meet its foresight responsibilities, these varied functions must be borne in mind.

CONGRESSIONAL BUDGET OFFICE

It is the view of the Congressional Budget Office that everything it does is related to future prospects. Many of its functions are spelled out in law and relate to the annual budget. In meeting these responsibilities, the Budget Office looks ahead five years in its endeavor to forecast the impact of economic assumptions, Federal spending and tax decisions on the budget. While it is customary for CBO to limit itself to five-year projections—whether it is estimating the consequences of budgetary decisions, or the likely costs of legislative proposals—the Budget Office is not limited to such projections when circumstances suggest that going beyond five years would be more meaningful.

In addition to its many budget estimates mandated by law, CBO, upon request from committees that it serves on a priority basis, also prepares reports that look at issue areas in terms of their impact on the Federal budget and the economy.

CBO is now, and has been for some period of years, staffed at 222 employees. Given this staff size and its already full research agenda, it remains uncertain whether CBO's capacity to assist Members and Committees with foresight needs can be expanded much beyond the level that is currently provided.

CONGRESSIONAL RESEARCH SERVICE

The Congressional Research Service is responsible for providing all Members, congressional committees, officers of the House and Senate and their staffs with information, research and analysis on every subject of interest to them. It also, on a more limited basis, assists most informal congressional groups and its sister support agencies. For this purpose, it has 860 authorized budgeted positions, of which about 337 are dedicated to policy analysis and research activities. Futures research and analyses responsibilities are assigned to CRS's seven research divisions. Staff in those divisions are trained to perform futures research.

The capacity of CRS's staff to prepare foresight analyses is limited by the competing responsibilities that must be met. In meeting the many informational and research analytical needs of Congress, CRS responds to 450,000 inquiries a year. Within the time and resources available, the Service endeavors to assist Congress in its foresight needs. For example, on a biennial basis, its research staff prepares lists of emerging issues that committees may choose to examine in depth during the course of a Congress. Similarly, it provides close support to committees in the conduct of their hearings of proposed programs and activities of the Government and in the oversight of existing programs. For example, in the past, CRS has assisted committees (1) by identifying specific issue areas that need to be examined from a long-term perspective; (2) by identifying organizations that engage in futures research; and (3) by providing futures-related policy analysis. It has also analyzed proposals to create machinery and establish procedures that would coordinate, encourage, and expand efforts by the executive and legislative branches to obtain data and research that support foresight. The Service routinely responds to requests for analyses of trends.

Congress's requests to the Service continue to grow with each passing year with Service staff size remaining stable. Accordingly, the capacity of the Service to more fully assist Congress in foresight analysis, which is complex and time-consuming, remains uncertain.

GENERAL ACCOUNTING OFFICE

The General Accounting Office (GAO) employs about 5,100 people from a wide range of disciplines. In addition it utilizes consultants from all academic and professional disciplines where needed to supplement "on board" skills.

GAO has many responsibilities. Among the most significant of these is the dual statutory responsibility of (a) responding to the requests of committee chairmen for audit and evaluation work and other assistance over the range of legislative responsibilities, and (b) assisting the Congress by reviewing the economy, efficiency and effectiveness of Federal program and agency operations and of Federal contractors and grantees. As a long standing policy GAO also assists individual members within available resources.

These extensive responsibilities constitute a virtually infinite workload. As a result, GAO has in place a carefully defined system for planning how its resources can best be used to meet congressional needs over a multi-year period. A cornerstone of this is working with committees to identify with them the trends, issues, programs and agency operations which will be the subject of congressional action and to establish how GAO audits and evaluations can best contribute to fulfillment of the congressional role. Depending on the circumstances, individual audits and evaluations may be the subject of a committee or Member request or they may be performed under GAO's basic legislative responsibilities. In either case, to the maximum extent possible, they are timed to meet committee agendas.

As part of its planning process, GAO has identified 36 major issues of concern to the Congress. Within these, GAO identifies trends, as well as existing and emerging concerns, to which its work can best be directed. These issues range from those which have world-wide implications to those which affect the individual and the community and those which seek improvements in the way Government is managed. They include health, energy, income security, military preparedness, foreign economic assistance, intergovernmental relations and Federal procurement policy and practice.

In developing its multi-year work plans, GAO considers the results of its own analysis and evaluations, as well as the relevant expertise of people in and outside of Government. As the plans are carried out through individual assignments, GAO staff in each of the issue areas monitor trends and make needed plan modifications. All of this is with the objective of being able to do the audit and evaluation work necessary to provide the Congress and its committees with objective, informed reports, recommendations, and testimony when the Congress is best able to use them.

By virtue of its basic mission, GAO work emphasizes recommendations which will make programs more effective and less costly in fulfilling legislative objectives and those that will improve agency operations or reduce their cost. GAO work, and the recommendations resulting from it, considers how programs are actually being carried out by first-hand observation throughout the Nation and the world. It also considers the potential impact of changing conditions where they are empirically discernible.

Over the range of its mission responsibilities GAO seeks to assist the Congress in anticipating its needs and to provide needed factual information and analysis. As the Congress expands its foresight role, GAO will assist within available resources and with due consideration of the other congressional needs to which it must respond.

OFFICE OF TECHNOLOGY ASSESSMENT

The Act of establishing OTA, passed in 1972, provides that:

> the basic function of the office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinating information which may assist the Congress.

The Act clearly provides OTA with a mandate to participate in the foresight function of Congress. In fact, OTA reports typically deal not only with the current state of the art of a technology, but with probable consequences five, ten, twenty or more years downstream.

Studies conducted by OTA must be approved by its Board, composed of Members of the Senate and House. Typically, parts of studies are performed by contractors drawn from the private sector. Information from contractor reports is one input to the reports delivered to Congress which are written by OTA staff. Such reports undergo extensive external and internal review to assure accuracy, balance, and fairness before delivery to Congress. Because OTA must balance the need for information about current technological advances with the need for early warning about emerging technologies, the Office may not always be able to conduct every foresight-related analysis that is desired.

OTA's studies usually take more than a year to complete. Accordingly, OTA has instituted special procedures to try to anticipate those areas where results of studies will be required 18 to 24 months hence. For the last four years, senior management has held an annual retreat to identify issues which may be of interest to Congress. Participants are encouraged to think ahead for a number of years so as to identify emerging trends. At one time, OTA had an Assistant to the Director for new and emerging technologies who was assigned to identify developments that might lead to legislative issues. However, it was concluded that centralizing this function was not completely satisfactory. OTA found that "early warning" requires people who are experts in the fields in which emerging technology is likely to occur; so this function has become a part of each program's component.

OTA has the interdisciplinary expertise to increase its foresight activities for Congress. However, if current budgetary constraints continue, it is unlikely that OTA will be able to significantly increase the resources it devotes to congressional foresight.

CONCLUDING OBSERVATION

Despite the conventional wisdom that the Congress is captured by the immediate, there is evidence to suggest otherwise. A significant number, perhaps even a majority, of the Members of Congress are fully cognizant of the need to look at long-term needs and problems and to marshal the research and analytical thinking crucial to the fullest possible understanding of what the Nation faces. Congressmen are also aware of how to go about fashioning responsive policies and programs and how to approach allocation and commitment of Federal money for these needs and problems. Through systematic and vigorous assimilation of information and analysis from every conceivable source, the Congress undertakes to deliberate and formulate policies to assure the progress and survival of the Nation. Its commitment to this critical task will determine in large measure, the extent to which, over the next 15 years, it allocates its time and research resources to the provision of foresight analysis.

FHP/ljb

Word & World
Volume IV, Number 4

The Future of the Creation: The Central Challenge for Theologians

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ALL IS NOT WELL WITH THE CREATION.[1]

There are many symptoms. While millions are starving in Africa, American farmers are paid not to grow food. An epidemic of cancer, thought to be caused by chemical wastes, rages through the fish populations of many U.S. rivers. Some alienated individual kills random strangers by putting cyanide in Tylenol capsules.

Underlying these symptoms is a host of interrelated problems—poverty, injustice, environmental pollution, population growth, destruction and depletion of resources, fear, hatred, insecurity, greed, and much more. But even these "problems" are not the root cause.

At the very root, the difficulty facing the creation is that the vision of the future that has been guiding human affairs has failed, and no viable alternative has emerged.

Herein lies an opportunity and a challenge for theologians: to help formulate a viable vision of the future of the creation. With such a vision, the church[2] has an opportunity to provide powerful and urgently needed leadership. Without such a vision, the church will become increasingly irrelevant to a creation moving rapidly toward disaster.

I. THE CREATION: 1984 AND BEYOND

Over the past decade there have been several studies of the future of the creation.[3] In virtually every case, these studies have accepted or assumed the vision that has for decades shaped the human future: prosperity through development, and security through violence, or at least the threat of violence. Collectively these studies demonstrate that this vision of the future has failed because development—as now understood—is not sustainable, and violence threatens literally to destroy the creation.

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[1] "Creation" is used here in a limited sense, synonymous with "Earth," including its human and nonhuman living populations, and its nonliving parts.

[2] The word "church" is used here to mean the whole collection of incorporated and unincorporated organizations that attempt to make visible the real (invisible) church ("body of Christ").

[3] For an introduction to these studies see the two survey articles by John Richardson published in *Futures* 10/5 (October, 1978) 388-404 and *Futures* 10/6 (December, 1978) 476-91; D. Meadow, J. Richardson, and G. Bruckmann, *Groping in the Dark* (New York: Wiley, 1982); and Office of Technology Assessment, *Global Models, World Futures, and Public Policy: A Critique* (Washington, D.C.: U.S. Government Printing Office, 1982).

A. Prosperity, fertility, and the sustainability problem.

People seeking to be prosperous make demands on the nonhuman parts of creation—the rest of creation. The essence of the sustainability problem is that there are limits to the human demands that can be sustained by the rest of creation. In other words, there is an inherent tension or conflict between the biblical injunction to "be fruitful, multiply and fill the earth" (Gen 1:28) and to "cultivate and take care of it" (Gen 2:15).

In localized situations, the sustainability problem is not new. Lot and Abraham, for example, discovered that in their numbers at their standard of prosperity "the land was not sufficient to accommodate them both" (Gen 13:6). The resulting "dispute" was resolved by migration; Lot moved to the well-irrigated Jordan plain.

What is new about the sustainability problem is that Lot's solution is no longer open; there are no more "Jordan plains" into which to migrate. From its localized beginings, the sustainability problem has become global in extent.

The process of "development" has long seemed to be the only global solution to the sustainability problem. Through "development" it has been thought possible to make the developing countries like the developed ones, e.g., having high standards of living and stable (or at most slowly growing) populations. The developed countries achieved their current circumstances through two interrelated phenomena, industrialization and a demographic transition. It is now doubtful that the "developing" countries can experience industrialization and a demographic transition anything like what occurred in the developed nations.

The high standards of living achieved in the developed nations were accomplished in large part through the invention and application of technologies for using energy (first coal and later petroleum) and capital to replace human labor and to increase production. As production increased, capital (machines, roads, buildings, railroads, etc.) accumulated, permitting still more use of energy per capita, a higher standard of living, yet more capital accumulation, education, and research. Abundant, inexpensive energy—especially petroleum—was essential to industrialization.

Unfortunately, neither petroleum nor any other comparably abundant, inexpensive, clean energy source will be available to make development possible in the developing countries. At the beginning of the industrial revolution, the world had about 2,000 billion barrels of oil. A quarter has now been burned by the industrialized nations. By about the turn of the century, roughly half will have been burned (80 percent by the industrialized nations), and oil production will be on the decline.

Depletion of the world's petroleum resources is not a serious problem if some other abundant, clean, inexpensive energy source will take its place. Unfortunately, no such energy source is in sight. Recent analysis by the Department of Energy show that, in spite of contributions from all anticipated technological advancements and competition from all other sources of energy, world petroleum prices (and the prices of other energy forms in equivalent quantities and qualities) will rise to $40-$80 per barrel (in 1982 dollars) by the turn of the century.[4]

The effect of high energy prices is particularly devastating for the agricultural sector, which is critical for development. Modern "green revolution" agriculture is no longer a way of converting solar energy into food calories, but rather a means of using solar energy to transmute fossil fuels into food calories. Roughly, three calories of fossil fuels are now required to produce a single calorie of food energy in the form of grain. If the food calories are in the form of grain-fed beef, as much as 15 calories of fossil fuels are needed.

The food prospects for the poorest countries are not good. The latest global food projections for the year 2000, available from the U.S. Department of Agriculture, show food consumption (assuming neither drought nor massive food aid) falling 20 percent below the FAO minimum standard in large parts of Africa.[5] At this level, adults are unable to carry on normal work functions, and children cannot be expected to achieve their normal physical and mental capabilities. The problem is that even now these countries cannot afford fossil fuels either before or after they are transmuted into food, and as energy prices increase, their prospects will become still more difficult.

In short, at the high prices of energy now expected, industrialization and energy-intensive agriculture are not options for the poorest nations. The industrial economies of the world were built with energy that cost about $10 per barrel (1982 dollars). If in the future energy should cost perhaps 10, 20, or even 30 percent more, development based on Western industrialization might be an option, but with energy to cost 4 to 8 times more, development based on the substitution of energy and capital for human labor is simply not a possibility for the poorest countries.

The altered energy and development prospects have major implications for efforts to stabilize the world population. During and after the industrial revolution, mortality rates in the now-industrialized nations declined. A decade or so later, desired family sizes dropped and fertility rates declined. Populations grew rapidly for a time, and then stabilized. In this way the industrialized nations made a demographic transition from high birth rates and high mortality rates to low birth and mortality rates.

It has long been assumed that a similar demographic transition would automatically follow industrialization in the developing countries. The experience of some of the newly industrialized nations (e.g., Taiwan and South Korea) encouraged this hope.

Unfortunately, however, the vast majority of the poorest developing countries are making little or no progress in stabilizing their populations. Medical technology has reduced mortality rates, but fertility rates often remain high. The World Bank reports that the population growth rate of the poorest 34

[4] U.S. Department of Energy, *Energy Projections to the Year 2010* (Washington, D.C.: U.S. Government Printing Office, 1983); and U.S. Department of Energy, *1982 Annual Energy Outlook* (Washington, D.C.: U.S. Government Printing Office, 1983).

[5] G. O. Barney, Study Director, *The Global 2000 Report to the President* (3 vols.; Washington, D.C.: U.S. Government Printing Office, 1980) 1.41 and 2.73-104, 272-297.

nations (less China and India) *increased* from 2.5 percent in the 1960s to 2.6 percent in the 1970s, and the Bank now expects the growth rate for more than half of the low- and middle-income countries to increase to 2.9 percent for the 1980-2000 period. At best, the populations of the developing countries will not stop growing for another century.[6]

Population growth cannot go on forever. There is a limit to the number of humans that the rest of creation can support. This "carrying capacity" has been estimated by the U.S. National Academy of Sciences to be somewhere between 10 and 30 billion people.[7]

Human numbers are rapidly approaching the Academy's estimate of the carrying capacity. The human population stands today at about 4.5 billion, and each year it sets a new record increase. By the turn of the century the percentage growth is expected to decline from the current 1.8 percent per year to perhaps 1.6 percent, but the annual increment to the human number will jump from the current 75 million to 100 million. Short of some major unforeseen developments, the human population will reach 6 billion before children born today graduate from high school. (This increase is the equivalent of adding another China—and then some—to today's population.) Many alive today might live to see the 10 billion mark reached.

As the carrying capacity of the creation is approached, a number of unpleasant developments must be expected. In the poorest countries, the carrying capacity will actually be eroded or destroyed. Already in many of the poorest nations, overgrazing combined with fuelwood gathering and burning of dung for fuel is stripping all the vegetation from arid areas, and deserts are expanding. In the steep tropical areas of South and Southeast Asia, forests are being removed for slash-and-burn agriculture and for fuelwood and charcoal production. Soon thereafter the thin soils erode to leave a seriously degraded land. In such situations, the limited food, shelter, clothing, and medical care keep infant mortality rates high, leading parents to want still more children to make up for those they expect will die in infancy.[8]

The affluence of the industrialized nations will have equal or greater impacts. As domestic petroleum resources are depleted in the industrialized nations, competition for foreign sources will grow. Ultimately about 80 percent of the world's total supply of petroleum is likely to be burned by the industrialized nations. The carbon dioxide produced from burning petroleum (and coal) has already significantly altered the global atmosphere and within the next generation is likely to change the global temperature and precipitation patterns enough to disrupt agriculture world-wide and to increase ocean levels several feet, flooding urban, industrial and agricultural areas around the world.[9]

As these unpleasant developments occur, tensions and disputes—not unlike those experienced by Lot and Abram—can be expected. The means used to resolve tensions and conflicts can therefore be expected to become increasingly important.

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[6] World Bank, *World Development Report 1983* (Oxford: Oxford University, 1983); A. J. Coale, "Recent Trends in Fertility in Less Developed Countries," *Science* 221 (26 August, 1983) 829.

[7] National Research Council, National Academy of Sciences, *Resources and Man* (San Francisco: Freeman, 1969) 5.

[8] G. O. Barney, *The Global 2000 Report*, 2.390-430.

[9] National Research Council, National Academy of Sciences, *Changing Climate* (Washington, D.C.: National Academy Press, 1983); S. Seidell and D. Keyes, *Can We Delay a Greenhouse Warming?* (Washington, D.C.: Environmental Protection Agency, September, 1983).

B. The violence problem.

The first biblical example of conflict resolution is a violent one—a jealous Cain killing his brother Abel. In most cultures murder is now regarded as an unacceptable means of conflict resolution, but among large groups of people (nations), organized murder (war) is still very much accepted as a last-resort means of conflict resolution.

Given the assumption that ultimately a nation's "security" depends on its ability to wage war, it is not surprising that nations have pursued every opportunity to increase their capacity to do violence. Acceptance of this notion of security is the fundamental force powering the arms race.

The notion that security can be derived from violence has failed. The search for ever more destructive weapons has led from the stones that Cain might have used to nuclear weapons. For a few decades after their invention and first use by the United States, it was argued that nuclear weapons provided security through the "deterrence" produced by "mutually assured destruction." It is now apparent that the use of nuclear weapons in even an unanswered first strike is, in fact, suicide.

Recently a large group of scientists from the U.S. and the U.S.S.R. analyzed the consequences of exploding various fractions of the world's current 12,000 megaton (MT) nuclear arsenal—the equivalent of 1 million Hiroshima-sized bombs. They concluded that a moderate to large nuclear exchange would kill outright up to a quarter of the world's population. An equal number would suffer serious injuries requiring immediate medical attention—which would be largely unavailable.[10]

The long-term consequences would be even more serious. Within a week, the amount of sunlight at ground level could be reduced to just a few percent of normal over the entire planet.[11] The unbroken gloom would last for months. Land temperatures would go to subfreezing levels for months. Even if the exchange were to occur in the summer, many areas might be subject to continuous snowfall for months. Major climatic changes would occur and last for years.

A nuclear exchange would leave survivors facing extreme cold, hunger, water shortages, and pollution—all in twilight or darkness and largely without the support of organized society. The environment that would confront most human beings and other organisms would be so altered, and so malign, that extreme and widespread damage to living systems would be unavoidable. Most plants would die from lack of light and the extreme cold. Most animals would soon die from lack of water and food, and any that survived until the skies began to clear would be blinded by increased ultraviolet light and unable to find what little food might remain.

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[10] R. P. Turco, et al., "Nuclear Winter: Global Consequences of Multiple Nuclear Explosives," and P. R. Ehrlich, "Long-term Biological Consequences of Nuclear War," *Science* 222 (23 December, 1983) 1283-92 and 1293-1304; "Three Minutes to Midnight," *Bulletin of the Atomic Scientists* 40 (January, 1984) 2.

[11] Unlike previous studies, the new analysis shows large disturbances in the global circulation patterns which could accelerate the transport of smoke, dust, and radioactivity to the Southern Hemisphere, and involve the entire planet in the aftereffects.

These findings make clear that a nuclear exchange—or even an unanswered first strike—could end human civilization.

II. THE FAILED VISION AND THE CHALLENGE TO THEOLOGIANS

The great vision guiding human affairs—prosperity through industrial development and a demographic transition, and security through violence (or the threat of violence)—has failed. It is no longer possible to pretend that all peoples can achieve prosperity through development styled after the industrialized nations: the resources—especially inexpensive, environmentally benign energy sources—and the capital are not sufficient. Furthermore, no technology is in sight that would allow even the present world population to live sustainably while making the per capita demands on the world's resources and environment that people living in the industrialized nations do. Similarly, it is no longer defensible to pretend that violence (or the threat of violence) produces security. Living in a state of "mutually assured destruction" is not peace. Possessing weapons capable of destroying all human civilization—including one's own—provides neither comfort nor defense.

Is there hope? Perhaps. There is no question that the creation was designed in such a way that it could go on a good while longer. What threatens it is not the result of the design of the creation, but rather the result of human behavior, human will. There is hope, therefore, if humans—all of us—can change.

Can humans change? This is at least in part a theological question, and I am not encouraged by what I often hear from the pulpit: "Humans exist in a sinful world. What each person should do is prepare for judgment day by accepting God's grace. Then, be a good steward of your time, talent and treasure.[12] Do what little good you can individually in the world, but forget about putting the world right. We humans are in bondage to sin and cannot free ourselves."[13]

While not a theologian, I have difficulty reconciling this message with what Paul wrote to the Romans:

> Does it follow that we should remain in sin . . . ? Of course not. We are dead to sin, so how can we continue to live in it? You have been taught that when we were baptized in Christ Jesus we were baptized in his death; in other words when we were baptized we went into the tomb with him and joined him in death so that as Christ was raised from the dead by the Father's glory, we too might live a new life. (Rom 6:1-4)

Paul, it seems, is saying that post-resurrection things are different. We are no longer in bondage to sin; the creation is no longer hopelessly condemned to continue "groaning" (Rom 8:22). There are no longer inherent limits to goodness, and the task of the post-resurrection "body of Christ" is to get on with the "new life."

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[12] Judging by the examples usually given, this means usher, sing in the choir, evangelize, proselytize, teach Sunday School, and give money to God's work, i.e., to the local parish.

[13] This last point is actually "confessed" weekly by my own denomination.

Given the threats to the creation that exist today, *the* central challenge for theologians is to resolve this question: Is a creation-wide "new life"—a profound change in human behavior—theoretically possible? Do the events remembered on Good Friday and Easter offer hope for the whole creation as well as the individual? Or are we collectively still in bondage to sin, and the creation condemned to continue groaning?

If theologians can answer affirmatively that a "new life" offers hope for the creation as well as the individual, then the church had best get serious about its work. Again, the primary challenge is to the theologians. How was the creation supposed to have worked before sin? How *could* it work post-resurrection? What is possible for the creation in the "new life"? What vision can the church offer to replace the vision that has failed?[14]

In defining a new vision, theologians must deal directly with the sustainability issue—the modern, global version of the problem faced by Lot and Abram. Currently one of the most serious threats to the creation is the failure of the church to comprehend the conflict between human fruitfulness and the necessity to cultivate and take care of the creation.[15] To address this issue theologians will need to learn much more about the creation, technology, and science—especially biological science.[16]

The new vision will also require theologians to deal with the problem of violence and conflict resolution. Some thought has already been given to these matters in the Christian theory of the just war. This theory holds that there are conditions under which Christians may join in the mass taking of life that nation-states employ as a means of conflict resolution when a nation-state's "vital interests" and "national security" are thought at risk. This theory needs urgent reconsideration in light of what is now known about the long-term global consequences of nuclear war, and some limited progress in this direction has been made. [17] In addition, the revised theory needs to be applied openly and regularly to real wars. Is one to assume that all of the 40-odd wars in progress now are just?

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[14] For an introduction to some of the thinking already in progress on what might be a viable new vision, see the various *Riverdale Papers* by Thomas Berry (Riverdale Center for Religious Research, Riverdale, New York 10471); *World Faiths and the New World Order*, ed. J. Gremillion and W. Ryan (Washington, D.C.: Interreligious Peace Colloquium, 1978); O. W. Markley and W. W. Harman, *Changing Images of Man* (Oxford: Pergamon, 1982); Science Council of Canada, *Canada as a Conserver Society* (Hull: Printing and Publishing, 1977); W. W. Harman, *An Incomplete Guide to the Future* (Stanford: Stanford Alumni Association, 1976); W. E. Diehl, *Thank God, It's Monday!* (Philadelphia: Fortress, 1982); E. F. Schumacher, "Buddhist Economics," *Small is Beautiful* (New York: Harper & Row, 1973) 50-58; *The Report from Iron Mountain: On the Possibility and Desirability of Peace* (New York: Dial, 1967); L. R. Brown, *Building a Sustainable Society* (New York: Norton, 1981); L. R. Brown, *The State of the World 1984* (New York: Norton, 1984); W. I. Thompson, *Passages About Earth* (New York: Harper & Row, 1981); W. Brandt, *North-South: A Programme for Survival* (Cambridge: MIT, 1980); R. E. Miles, Jr., *Awakening from the American Dream* (New York: Universe Books, 1977); G. Snyder, *Turtle Island* (New York: New Directions, 1974); R. Reines, J. Todd, I. McHarg, P. Soleri, R. S. Wurman, *What Do We Use for Lifeboats When the Ship Goes Down?* (New York: Harper & Row, 1976); G. Vickers, *Freedom in a Rocking Boat* (Baltimore: Pelican Book, 1972); W. Berry, *The Unsettling of America* (San Francisco: Sierra Club Books, 1977); J. Schell, "Reflections (Nuclear War—Abolition and Deliberate Policy)," *The New Yorker* (January 2 and January 9, 1984); Carl Sagan, "Nuclear War and Climatic Catastrophy: Some Policy Implications," *Foreign Affairs* 62/2 (Winter, 1983-84) 257-292.

[15] As but one example of this failure, my own denomination recently went through years of committee work to produce a new hymnal that contains not one hymn concerned with the human responsibility for tilling and keeping and for human fertility. And it will be at least a decade before the committees begin on the next hymnal.

[16] J. C. Fletcher, "Internationalizing Theological Education," *The Futures of Protestant Seminaries* (Washington, D.C.: The Alban Institute, 1983); Committee on Science and Creationism, National Academy of Sciences, *Science and Creationism* (Washington, D.C.: National Academy Press, 1984).

But the new vision needs to go far beyond the issues of war to address other forms of violence. Virtually every nation engages in more subtle forms of violence, in ruthless, unjust, conflict-producing acts—exploitation through currency manipulation and trade barriers, assassination of political leaders, bribing officials, torture, terrorism, covert military attacks, spying, spreading half-truths and outright lies, etc. Corporations, in the name of market competition, engage in practices that are not unrelated. Since Christians are called upon to be directly involved in these acts, the new vision needs to include a theological theory of just competition, complete with guidance as to when Christians may feel justified in forms of violence that fall somewhat short of war but that could provoke war.

Theologians must also examine the role Christianity has in creating tensions and war. The hostility of Christians to people of other faiths is a serious problem for the creation. As but one example, Christian abuses of Muslims (including the massacres at Sabra and Chatila) are a fundamental cause of the war in Lebanon. Similarly, the church has on more than one occasion contributed enormously to injustice. The ongoing exploitation and corruption by parts of the church in Latin America are one example and a contributing cause of the conflict there.

Theologians must also think about the conflicts that they themselves produce. The "body of Christ" has been badly divided by theologians in dispute over issues that without question are beyond human comprehension or are legitimately open to different interpretations. It seems to me that more than one theologian has in effect raised idolatry to a new standard by allowing a pet notion—not even a graven image—to assume paramount importance and command total devotion. Unnecessary divisions are all counterproductive and some disastrous. While British policy is also a factor, it is hard to imagine a more appalling Christian witness than the ongoing war in Northern Ireland.

The creation stands threatened today. At any time nuclear weapons could destroy the creation in minutes. Within a single generation, our unsustainable and unjust vision of development could do ecological damage that would approach that of a modest nuclear war. Destruction of the creation by nuclear war or by unsustainable management of human fertility and human demands would be a human failure of the ultimate proportions.

The human vision has failed. Without a new vision that recognizes the potential in the creation's design there is no hope. Without hope there is no peace.

The challenge and opportunity to theologians is enormous. It is not to preach "peace, peace" when there is no peace, but rather to bring first a new vision, then hope, and finally peace to a troubled creation.

[17] U.S. Catholic Bishops' Pastoral Letter on War and Peace, "The Challenges of Peace: God's Challenge and our Response," *Origins* 13/1 (May 19, 1983).